QRAE II User's Guide

RAE SYSTEMS

P/N 020-4100-000 Rev. A
October 2006

© Copyright 2006 RAE Systems, Inc.

Contents

Read Before Operating 3
General Information 6
  Specifications 7
Charging The QRAE II Battery 8
  Clock Battery 9
User Interface 10
  User Interface Icons 10
  Turning The QRAE II On 11
  Inverting The Display 12
  Testing The Alarms (Anytime) 12
  Turning The QRAE II Off 12
Operating The QRAE II 13
  Mode Overview 13
  Normal Mode 14
  Diagnostic Mode 15
Programming Mode 18
  Enter Programming Mode 19
  Navigating Programming Mode 20
  Calibrate Monitor 21
  Change Alarm Limits 23
  Change Datalog 26
  Change Monitor Setup 29
  Change Sensor Configuration 34
Alarm Signal Summary 37
Calibrating The QRAE II 38
  Connecting The Calibration Adapter 38
  Disconnecting The Calibration Adapter 39
  Zero (Fresh Air) Calibration 40
  Multiple Sensor Calibration 41
  Single Sensor Calibration 42
Connecting To A Computer 44
Transferring Data To & From A Computer 44
Downloading The Datalog To A PC 44
Uploading Firmware To The QRAE II From A PC 45
Maintenance 46
  Replacing the QRAE II Li-Ion Battery 46
  Installing The Alkaline Battery Adapter 47
  Charging A Spare QRAE II Li-Ion Battery 48
  Replacing Sensors 49
  Replacing The Filter 50
  Cleaning 51
  Firmware Updates 51
  Ordering Replacement Parts 51
  Troubleshooting 52

Technical Support 53
RAE Systems Contacts 53
Appendix A: Regulatory Information.....66

WARNINGS

Read Before Operating

This manual must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.

CAUTION!

To reduce the risk of electric shock, turn the power off before removing the monitor cover. Disconnect the battery before removing sensor module for service. Never operate the monitor when the cover is removed. Remove monitor cover and sensor module only in an area known to be non-hazardous.

Note: Users are recommended to refer to ISA -RP12.13, Part II-1987 for general information on installation, operation, and maintenance of combustible gas detection instruments.

⚠ WARNINGS ⚠

Use only RAE Systems rechargeable battery pack part number 020-3402-000, or alkaline battery pack part number 020-3403-000. Use only DURACELL MN1500 or ENERGIZER E91 batteries with alkaline battery pack. This instrument has not been tested in an explosive gas/air atmosphere having an oxygen concentration greater than 21%. Substitution of components may impair suitability for intrinsic safety. Recharge batteries only in non-hazardous locations. Do not connect the serial communication port in a hazardous location.

STATIC HAZARD: Clean only with a damp cloth.

For safety reasons this equipment must be operated and serviced by qualified personnel only. Read and understand instruction manual completely before operating or servicing.

Only the combustible gas detection portion of this instrument has been assessed for performance.

All newly purchased RAE Systems instruments should be bump tested by exposing the sensor(s) to known concentrations of calibration gas before the instrument is put into service, and later, prior to each use. A bump test is defined as a brief exposure of the monitor to the calibration gas and the sensors to show response and trigger the lowest alarm set point for each sensor.

The QRAEII Multi Gas detector must be calibrated if it does not pass a Bump Test, or at least once every 180 days, depending on use and sensor exposure to poisons and contaminants.

- Calibration intervals and bump test procedures may vary due to national legislation.
- RAE Systems recommends using RAE calibration gas cylinders with a 4 gas mix containing 10 ppm H2S, 50 ppm CO, 50% LEL Methane, and 18.5% Oxygen.
- Any rapid up-scale reading followed by a declining or erratic reading may indicate a gas concentration beyond upper scale limit which may be hazardous.

Note: Bump test and calibration can also be performed by using the RAE Systems AutoRAE™ docking station.

.

⚠ AVERTISSEMENT ⚠

Utiliser seulement l'ensemble de batterie RAE Systems, la référence 020-3403-000. Utiliser uniquement des piles alcalines modele DURACELL MN1500 ou ENERGIZER E91 avec l'adaptateur piles alcalines Cet instrument n'a pas été testé dans une atmosphère de gaz/air explosive ayant une concentration d'oxygène plus élevée que 21%. La substitution de composants peut compromettre la sécurité intrinsèque. Ne charger les batteries que dans un emplacement désigné non dangereux. Ne reliez pas le port de communication série dans un endroit dangereux.

RISQUE D'ORIGINE ELECTROSTATIQUE: Nettoyer uniquement avec un chiffon humide.

Pour des raisons de sécurité, cet équipement doit être utilisé, entretenu et réparé uniquement par un personnel qualifié. Étudier le manuel d'instructions en entier avant d'utiliser, d'entretenir ou de réparer l'équipement.

Uniquement, la portion pour détecter les gaz combustibles de cet instrument a été évaluée.

Tout appareil neuf de RAE Systems doit préalablement passer le test de vérification d'étalonnage qui consiste à exposer les capteurs a une concentration connue de gaz étalon, et ce avant que l'instrument soit mis en service puis avant chaque utilisation. Une vérification d'étalonnage est définie par une exposition courte du détecteur au gaz d'étalonnage, ainsi les capteurs doivent réagir et déclencher les seuils d'alarmes bas pour chacun des gaz détectables.

Le détecteur multi gaz QRAEII doit être impérativement étalonné si il ne passe pas le test de vérification d'étalonnage, ou bien au moins tous les 180 jours, selon l'utilisation et l' exposition des capteurs a des gaz poisons ou a des niveaux élevés de contaminants.

- Les intervalles d'étalonnage et les procédures de vérifications peuvent varier en fonction des législations nationales.
- RAE Systems recommande d'utiliser les bouteilles d'étalonnage RAE Systems avec un mélange des quatre gaz suivant 10 ppm H2S, 50 ppm CO, 50% LIE méthane, et 18.5% d'oxygène.
- Toute variation de la lecture rapide et positive, suivie d'une baisse subite ou erratique de la valeur, peut indiquer une concentration de gaz hors gamme de détection qui peut être dangereuse.

Note : les vérifications d'étalonnage ainsi que les étalonnages peuvent être réalisés sur la station d'auto-étalonnage RAE Systems AutoRAE™.

General Information

QRAE II is a programmable Multi-gas monitor designed to provide continuous exposure monitoring of oxygen, hydrogen sulfide, carbon monoxide and combustible gases for workers in hazardous environments. It monitors with the following types of sensors:

1. Combustible gases are monitored with catalytic bead sensors.
2. Hydrogen sulfide and carbon monoxide are monitored with electrochemical sensors.
3. Oxygen is monitored with a solid polymer electrolyte (SPE) sensor.

Key Features

Lightweight and Compact
12.3 oz (350 g), handheld size.
Dependable and Accurate
14 hours of monitoring with microcontroller.
User Friendly
Menu-driven, intuitive end-use operation.
Programmable Alarm Thresholds
Audio buzzer and flashing display alarm.

- Standard configuration includes CO, H_2S, LEL and O_2 sensors
- Replaceable, rechargeable Li-Ion battery
- Large, easy-to-read display
- Datalogging with large memory
- Visual alarm with bright red flashing LEDs
- Loud audible alarm (95dB at 30 cm)
- Vibration alarm
- Rugged weather-resistant composite case

Specifications

QRAE II Specifications

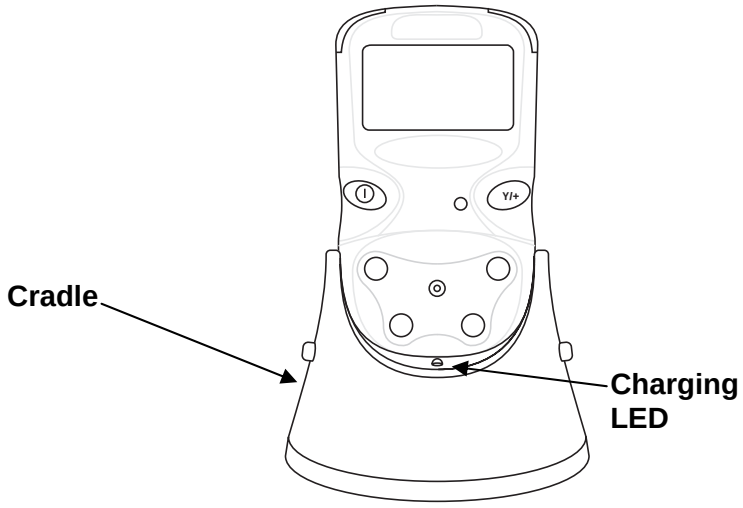
Configuration	Diffusion 4-gas with datalogging			
Dimensions:	4.94" L x 2.76" W x 1.5" H (125.5 mm x 70 mm x 38 mm)			
Weight:	12.3 oz (350 g) with battery			
Detectors:	2 Electrochemical toxic gases sensors			
	1 Solid Polymer Electrolyte oxygen sensor			
	1 Catalytic sensor for combustible level organics			
Battery:	Rechargeable 3.7V Li-ion battery pack (6-hour charge time) or a 3 AA alkaline battery adapter.			
Operating Time:	Up to 10 hours continuous w/ Li-ion battery pack			
Display:	4-line graphical LCD with automatic LED backlight for dim lighting conditions			
Keypad:	2 programming/operation keys			
Direct Readout:	Up to 4 simultaneous values with sensor name, battery charge, high and low values for all sensors, elapsed time, and datalogging on/off state			
Sampling Method:	Diffusion			
Range, Resolution & Response Time:	LEL	0-100%	1 %	15 sec
	O_2	0-30%	0.1 %	15 sec
	CO	0-1000 ppm	1 ppm	20 sec
	H_2S	0-100 ppm	1 ppm	30 sec
Alarm Settings:	Separate limits for TWA, STEL, Peak, Min			
Alarms:	$\geq$95 dB @ 30 cm buzzer, flashing red LEDs, vibration alarm, LCD to indicate exceeded preset limits, low battery, or sensor failure			
Calibration:	Two-point field calibration for fresh air and standard reference gas			
Protection:	Password protected calibration settings, alarm limits, and data			
Intrinsic Safety:	CSA Class 1, Division I, Group A, B, C, D, T4 (US & Canada), KEMA ATEX II 2G EEx d ia II C T4 (Europe)			
EM Immunity:	No effect when exposed to 0.43mW/cm^2 RF interference (5-watt transmitter at 12"/10cm).			
Data Storage:	64,000 readings (64 hours, 5 channels at 1 minute interval) in non-volatile memory.			
Datalog Interval:	Programmable 1- to 3,600-second intervals			
Alarm Settings:	Separate alarm limit settings for TWA, STEL, Low and High alarm.			
Communication:	Download data to PC and upload monitor setup from PC through an RS-232 link to PC serial port			
Temperature:	-20° C to 50° C (-4° F to 122° F)			
Humidity:	0% to 95% relative humidity (non-condensing)			

Caution:

Refer to RAE Systems Technical Note TN-114 for sensor cross-sensitivities.
Refer to RAE Systems Technical Note TN-144 for LEL sensor poisoning.

Charging The QRAE II Battery

Always fully charge the battery before using the QRAE II. The QRAE II's Li-ion battery is charged by placing the QRAE II in its cradle. Contacts on the bottom of the QRAE II meet the cradle's contacts, transferring power without other connections.



Note: Before setting the QRAE II into its charging cradle, visually inspect the contacts to make sure they are clean. If they are not, wipe them with a soft cloth. Do not use solvents or cleaners.

Follow this procedure to charge the QRAE II:

1. Plug the AC/DC adapter into the QRAE II's cradle.
2. Plug the AC/DC adapter into the wall outlet.
3. Place the QRAE II into the cradle and press down until the LED glows.

The QRAE II begins charging automatically. The LED in the cradle should glow red to indicate charging. During charging, the display shows this message:

Charging...

At the same time, the voltage is indicated in the QRAE II's display, as well as an electrical plug icon is shown next to the battery:

When the QRAE II's battery is fully charged, the message "Fully Charged!" is shown in the display, and the icons for the electrical plug and the battery are shown.

When charging is complete, the LED in the cradle glows green.

Note: A spare battery can be charged by placing it directly on the charging cradle. See "Charging A Spare QRAE II Battery" on page 48 for details.

Note: An Alkaline Battery Adapter (part number 020-3403-000), which uses three AA alkaline batteries, may be substituted for the Li-Ion battery. See page 47 for details.

WARNING!

To reduce the risk of ignition of hazardous atmospheres, recharge batteries only in areas known to be non-hazardous. Remove and replace batteries only in areas known to be non-hazardous.

Low Voltage Warning

When the battery's charge falls below the shutoff voltage, the display shows:

Battery low,
turning off. . .

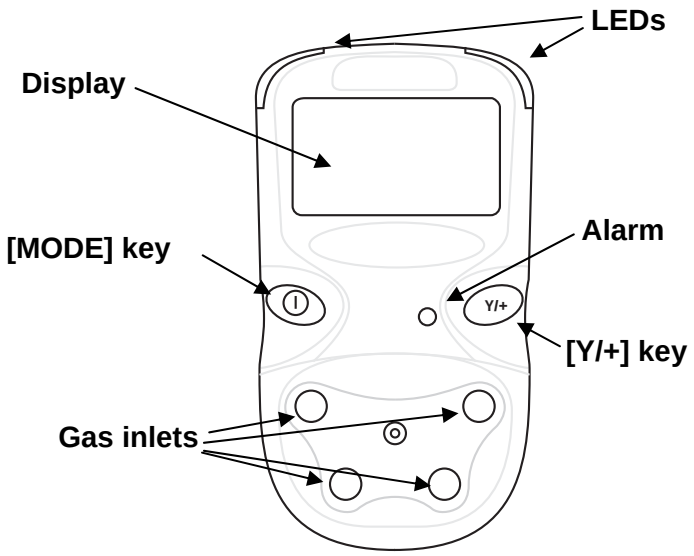
The QRAE II then turns itself off. Recharge the battery by placing the QRAE II in its cradle.

Clock Battery

An internal clock battery is mounted on one of the QRAE II's printed circuit boards. This long-life battery keeps settings in memory from being lost whenever the Li-ion battery or alkaline batteries are removed. This backup battery should last approximately five years, and must be replaced by an authorized RAE Systems service technician. It is not user-replaceable.

User Interface

The QRAE II's user interface consists of the display, LEDs, an alarm transducer, and two keys, labeled [MODE] and [Y/+]. The LCD display provides visual feedback that includes time, sensor mode, battery condition, and datalog enable/disable status.



User Interface Icons

Icon	Indication
	Battery Voltage low (flashing) Battery Low alarm triggered
	Battery fully charged
	Battery charging
	Alkaline Battery Adapter in use
	Alkaline Battery cannot be charged
	Datalogging active (flashing)
	Datalog memory full

Turning The QRAE II On

To turn the QRAE II on, hold down [MODE] for 2 seconds.

Caution: The alarm is very loud. During startup, you can mute most of the sound by holding a finger over the alarm port.

Note: Do not put tape over the alarm port to permanently mute it.

When starting up, the QRAE II simultaneously turns the backlight on and off, beeps once, blinks once, and vibrates. The screen shows:

On...

RAE Systems Inc.
QRAE II
(Language)

This is followed by a progression of screens that tell you the QRAE II's current settings:

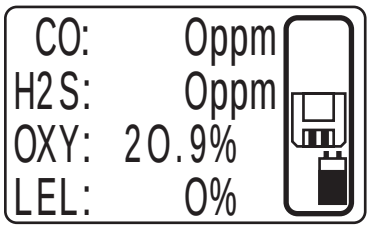
- Firmware version number and serial number
- List of installed sensors
- Last Calibration date and time
- Alarm Limits (High, Low, STEL, TWA)
- Today's date, the current time, and the current temperature
- Alarm Mode, battery voltage, shutoff voltage
- Datalog Mode,
- Datalog Period
- Datalog Time Left

The QRAE performs a final checkout and the screen shows a countdown to full operational functionality.

If Datalog is on, this message is displayed after the countdown:

Datalog Started

When the QRAE II is ready for use, it shows this screen:



Note: If datalogging is off, you will not see the datalogging icon (see icons, page 10).

Inverting The Display

The QRAE II is easy to read, whether held in the hand or clipped to a belt. To flip the screen, press the [Y/+] key and hold it down for 3 seconds. When the image inverts, release the key.

Testing The Alarms (Anytime)

Under normal non-alarm conditions, the buzzer, vibration alarm, LED, and backlight can be tested at any time by pressing [Y/+] once.

Turning The QRAE II Off

Press and hold [MODE]. In 2 seconds, a 5-second countdown to shutoff begins. You must hold your finger on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the QRAE II continues normal operation.

The countdown proceeds as follows, accompanied at each step with an alarm beep and light flash. The display shows the countdown in sequence:

Unit off in 5 seconds...
Unit off in 4 seconds...
Unit off in 3 seconds...
Unit off in 2 seconds...
Unit off in 1 seconds...
Unit off in 0 seconds...
Unit off...

When you see "Unit off..." release your finger from the [MODE] key. The QRAE II is now off.

Caution: The alarm is very loud. During shutdown, you can mute most of the sound by holding a finger over the alarm port.

Operating The QRAE II

Mode Overview

The QRAE II has three operational modes:

- **Normal** — see page 14 for detailed instructions.
- **Diagnostic** — see page 15 for detailed instructions.
- **Programming** — see page 19 for detailed instructions.

The following is an overview of the three modes:

Normal Mode is the default mode. It is accessed when you turn on the QRAE II. There are no access restrictions (you do not need a password), and it provides the indications and data you need most for typical monitoring applications, including:

- Readings of carbon monoxide (CO), hydrogen sulfide (H_2S), oxygen, and lower explosive limit (LEL).
- Peak.
- Min (minimum).
- STEL (short-term exposure limit).
- TWA (time-weighted average).
- Battery level.
- Run time since the QRAE II was turned on.
- Time, date, and temperature.
- Name of the LEL span gas used for calibration and the measurement gas.

Normal Mode also allows you to turn datalogging on and off and communicate with a PC to download data.

Diagnostic Mode is primarily designed for technicians during troubleshooting, although it also offers access to a few changeable parameters that you may rarely (if ever) change. You can enter Diagnostic Mode without restriction. In Diagnostic Mode, QRAE II displays readings in raw counts (cts) instead of units such as percentage or parts per million.

- Battery type indicator (Li-ion or alkaline)
- Battery level and shutoff voltage, and run time
- COx1 and COx5 (dual-range CO sensing)
- Display Contrast*
- Date, time, and temperature
- Backlight level and threshold*

Parameters marked with an asterisk (*) can be adjusted by entering Programming Mode from Diagnostic Mode. See Page 15 for details.

Programming Mode is password-protected and is includes adjustable settings to accomplish the following:

- Calibrate the monitor (this includes changing span gases and values, and selecting single or multiple sensor calibrations).
- Change alarm limits.
- Change/enable/disable the datalog.
- Change the monitor setup.
- Change the sensor configuration.

Normal Mode

Normal Mode is the default mode of the QRAE II when it is turned on. By using the [MODE] key, you can step through the screens that provide you with information from the sensors, as well as the QRAE II's current settings.

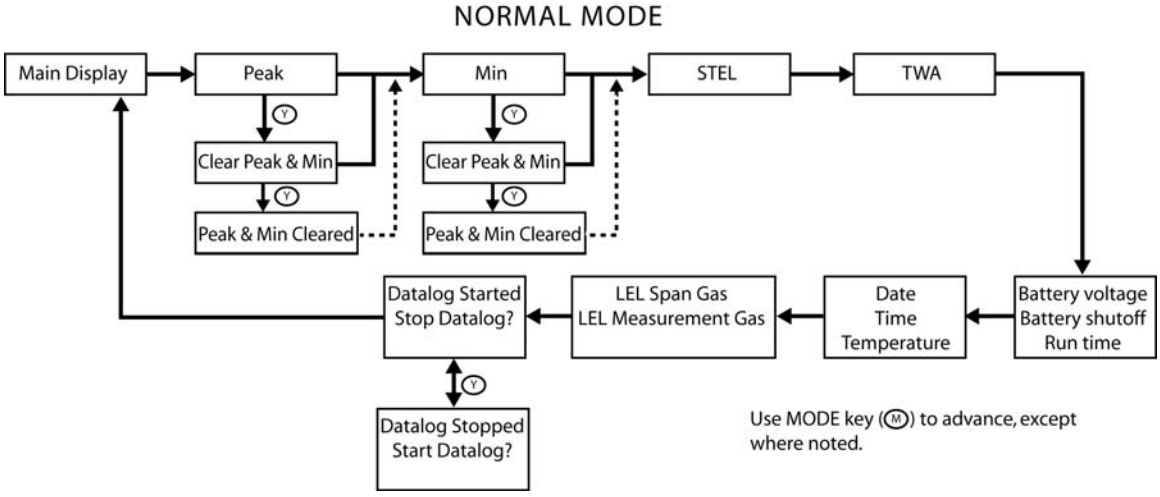
Enter Normal Mode:

With the QRAE II turned off, press and hold [MODE].
When the display turns on, release the keys. The QRAE II is now operating in Normal Mode.

To Exit Normal Mode:

Whenever you turn off the QRAE II, it will start up in Normal Mode, unless you intentionally place it in Diagnostic Mode. Follow the detailed instructions on entering Diagnostic Mode and Programming Mode for information on entering the other two modes.

After it is shut off, the QRAE II will automatically be in Normal Mode the next time you start it.



Peak. This tells you the highest reading for each sensor since the QRAE II was turned on. Press [Y/+] twice to clear the Peak and Min or [MODE] once to advance to Min.

Min. This tells you the lowest (minimum) reading for each sensor since the QRAE II was turned on. Press [Y/+] twice to clear the Peak and Min or [MODE] once to advance to STEL.

STEL. This provides Short Term Exposure Limit (STEL) data. These are based on 15-minute STEL values of H_2S and CO in ppm and 8-hour Time Weighted Average (TWA).

TWA. The TWA (time-weighted average) reading is the average reading of the gas concentration times the fraction of 8 hours that the monitor has been on.

Battery Voltage & Shutoff Voltage. This tells you the battery's voltage right now and the voltage at which the QRAE II will shut off. This varies, depending on whether a Li-ion battery or an alkaline battery adapter is used.

Run time. This tells you in hours and minutes how much time has elapsed since the QRAE II was turned on. Run time resets to 0:00 every time the QRAE II is turned on.

Date, Time, and Temperature. The full date of month, day, and year, as well as the 24-hour time in hours, minutes, and seconds, is shown. Temperature is shown in degrees Fahrenheit or Celsius, depending on the user configuration (see Set Temperature Unit, page 33).

LEL Span Gas, LEL Measurement Gas. These two indications tell you the gas selected for performing a span and for performing a full measurement on the LEL sensor.

Datalog Started. This informs you that the datalog has been started.

Communicate With PC. When the QRAE II is connected to a computer running ProRAE Studio software, it can download datalog data and upload revised firmware.

Note: If you access any screen in Normal Mode and leave that screen unattended for a few minutes, QRAE II automatically reverts to Normal Mode's main screen.

Diagnostic Mode

The QRAE II's Diagnostic Mode can only be accessed at startup time.

To Enter Diagnostic Mode:

1. With the QRAE II turned off, press and hold both [MODE] and [Y/+].
2. When the display turns on, release the keys.

To Exit Diagnostic Mode:

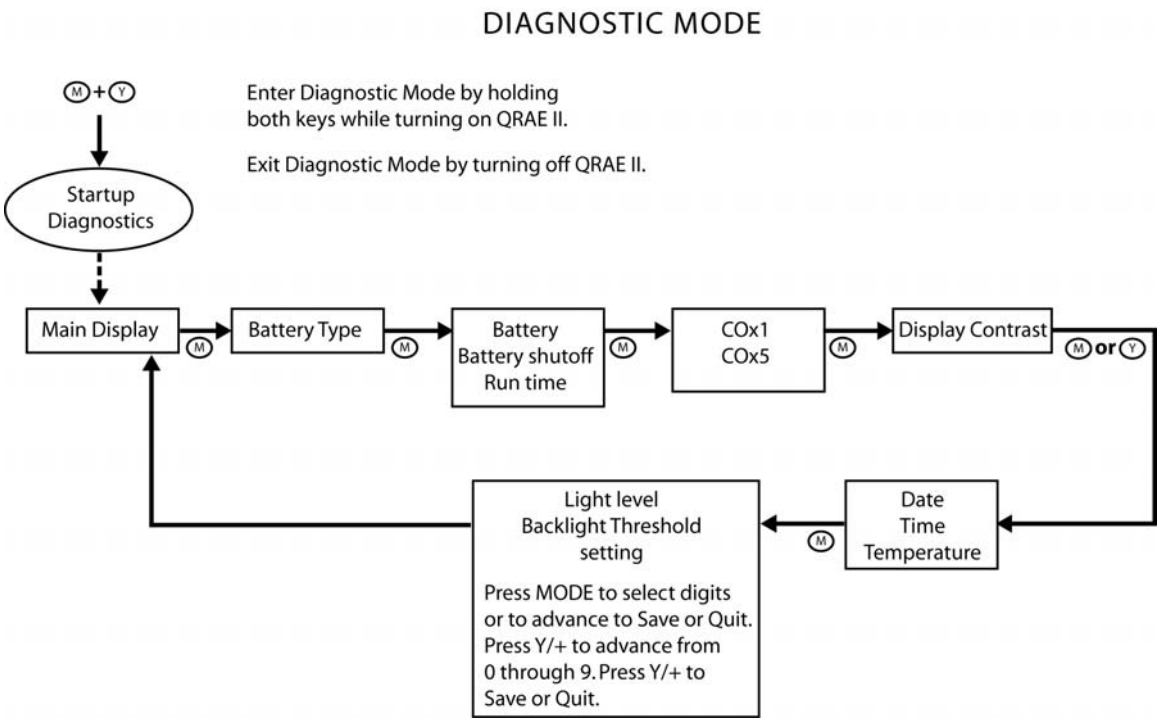
1. Turn off the QRAE II by pressing and holding [MODE]. There will be a standard shutoff countdown.
2. When it shuts off, you will be alerted. Release your finger.

Note: The next time you start QRAE II, hold only [MODE], and it will automatically be in Normal Mode.

When the QRAE II runs in Diagnostic Mode, the screen shows raw counts for sensors and battery levels (expressed as "cts," short for "counts"). You can step through other diagnostic information by pressing the [MODE] key. The items followed by an asterisk (*) are user-changeable.

- Battery type (Li-ion or alkaline)
- Battery level and shutoff voltage, and run time
- COx1 and COx5
- Display Contrast*
- Date, time, and temperature
- Backlight level and threshold*

Note: If the QRAE II is in its cradle, and the cradle is connected via its data cable to a PC, communication is possible in this mode.



Battery type. This indicates the type of battery that is currently in use (Li-ion or alkaline).

Battery level and shutoff voltage, and run time. This screen tells you the battery's voltage right now and the voltage at which the QRAE II will shut off. This varies, depending on whether a Li-ion battery or an alkaline battery adapter is used.

Run time. This tells you in hours and minutes how much time has elapsed since the QRAE II was turned on. Run time resets to 0:00 every time the QRAE II is turned on.

COx1 and COx5. The QRAE II's carbon monoxice (CO) sensing operates in two ranges, providing optimal sensing based on concentration. When the signal is in the low range, the COx5 reading is monitored, and when the signal is in the high range, the COx1 reading is monitored.

Display Contrast. You can set the display contrast for maximum sharpness under the lighting conditions in which you are operating.

1. Press [MODE] until the bar graph blinks, showing it is selected.
2. Repeatedly press the [Y/+] button to incrementally increase the darkness of the display.

   Note: Pressing [Y/+] several times causes the screen to appear fully dark. To return to a lighter screen, keep pressing [Y/+] until the screen suddenly becomes light again. This "wrap-around" feature ensures that you can correct for too much contrast setting.

3. Once the display contrast is set to your satisfaction, press [MODE], which will cause Save to blink. If you want to save the new setting, press [Y/+]. If you want to quit without saving the new setting, press [MODE] to advance to Quit. Then press [Y/+].

Date, Time, and Temperature. The full date of month, day, and year, as well as the 24-hour time in hours, minutes, and seconds, is shown. Temperature is shown in degrees Fahrenheit or Celsius, depending on the user configuration (see Set Temperature Unit, page 33).

Backlight level and threshold. This screen shows two values:

Light: The amount of ambient light where the QRAE is in operation.
Backlight Thresh Setting: The adjustable setting that sets the threshold at which the backlight illuminates when the QRAE II backlight is in automatic mode.

Whenever the QRAE II's backlight is in automatic mode and the amount of ambient light is lower than the Backlight Thresh Setting, the backlight illuminates.

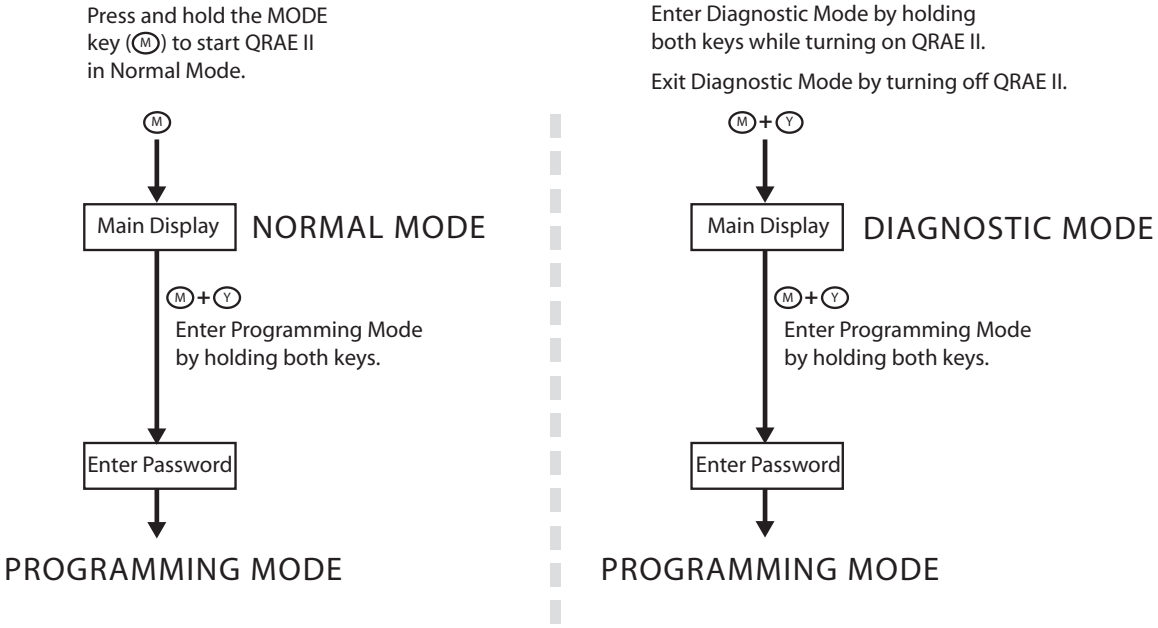
Set the threshold level for normal lighting conditions. However, if you are going to be in a dark location for extended periods and want to conserve battery power, you may want to set the QRAE's backlight to operate in manual mode. See page 32 for details.

Programming Mode

Programming Mode can be entered from Normal Mode or Diagnostic Mode. This mode contains most adjustable settings for the QRAE II. It is organized into five submenus:

- Calibrate Monitor
- Change Alarm Limits
- Change Datalog
- Change Monitor Setup
- Change Sensor Configuration

The following diagram shows how to enter Programming Mode from Normal Mode and from Diagnostic Mode:


Press and hold the MODE key (M) to start QRAE II in Normal Mode.
M
Main Display
NORMAL MODE
M+Y
Enter Programming Mode by holding both keys.
Enter Password
PROGRAMMING MODE
Enter Diagnostic Mode by holding both keys while turning on QRAE II.
Exit Diagnostic Mode by turning off QRAE II.
M+Y
Main Display
DIAGNOSTIC MODE
M+Y
Enter Programming Mode by holding both keys.
Enter Password
PROGRAMMING MODE

Enter Programming Mode

To enter Programming Mode, hold down [MODE] and [Y/+] simultaneously for three seconds. To exit this mode, press [MODE] repeatedly until the main concentration display shows.

When you enter Programming mode, you see:

Enter Password?

0000

OK Cancel

Increase a number by pressing the [Y/+] key (1, 2, 3 ... etc.). **Note:** The numbers advance until the number 9 and then "wrap around" to 0 again.

Advance to the next digit by pressing the [MODE] key (**0**000, 0**0**00, etc.). **Note:** The display has a "wrap-around," so once you reach the last digit, pressing [MODE] advances to the first digit again.

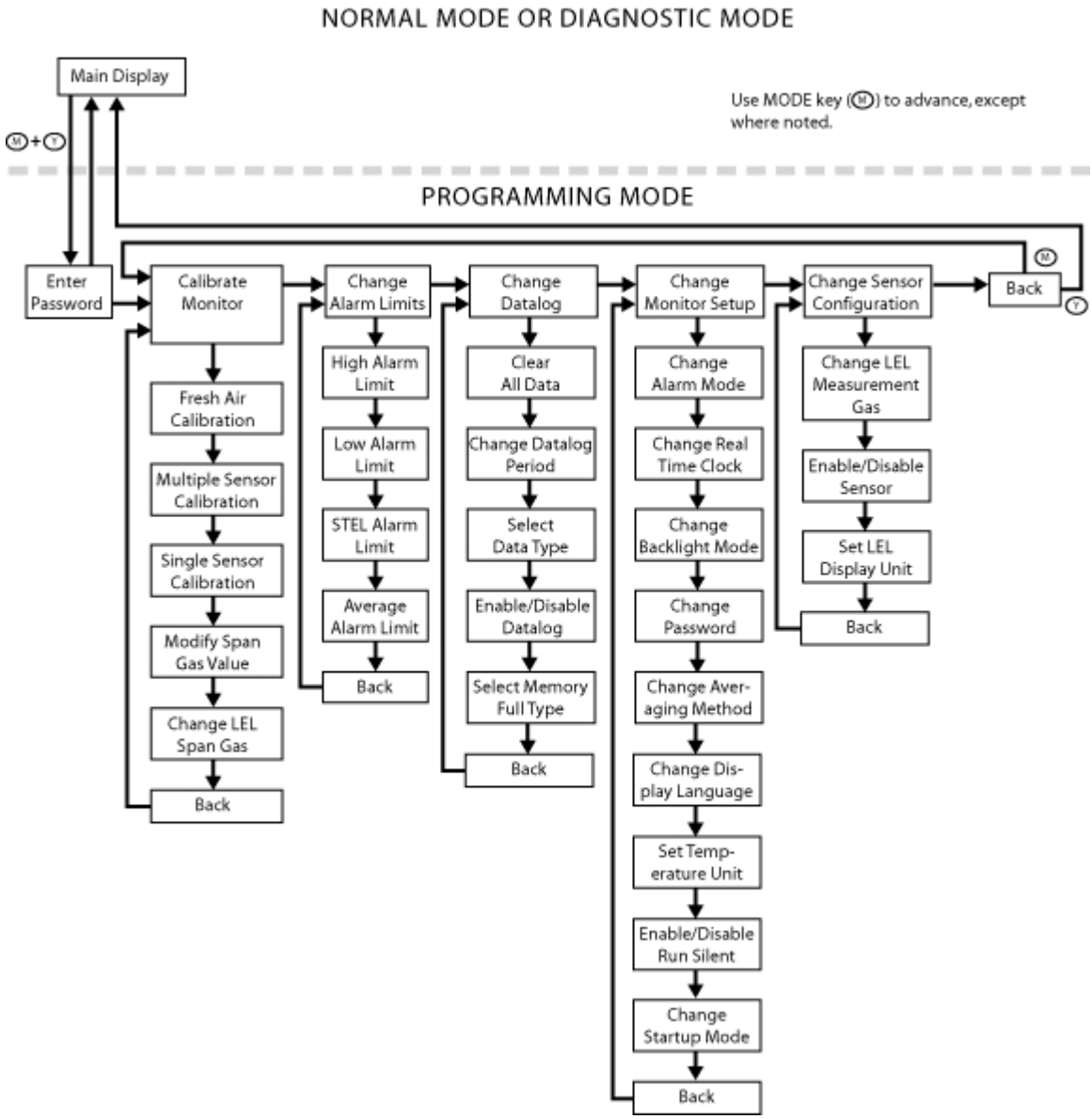
Once you are satisfied with the password, advance to OK, and press [MODE].
If you want to cancel, advance to Cancel and press the [Y/+] key.

Note: The default password is 0000. If you change the password, write it down and save it in a safe location. You do not have to change the password from 0000. You can simply continue using 0000, step through the digits and then press the [Y/+] key to enter Programming Mode.

Navigating Programming Mode

The following diagram shows Programming Mode's five submenus and how to navigate through them.

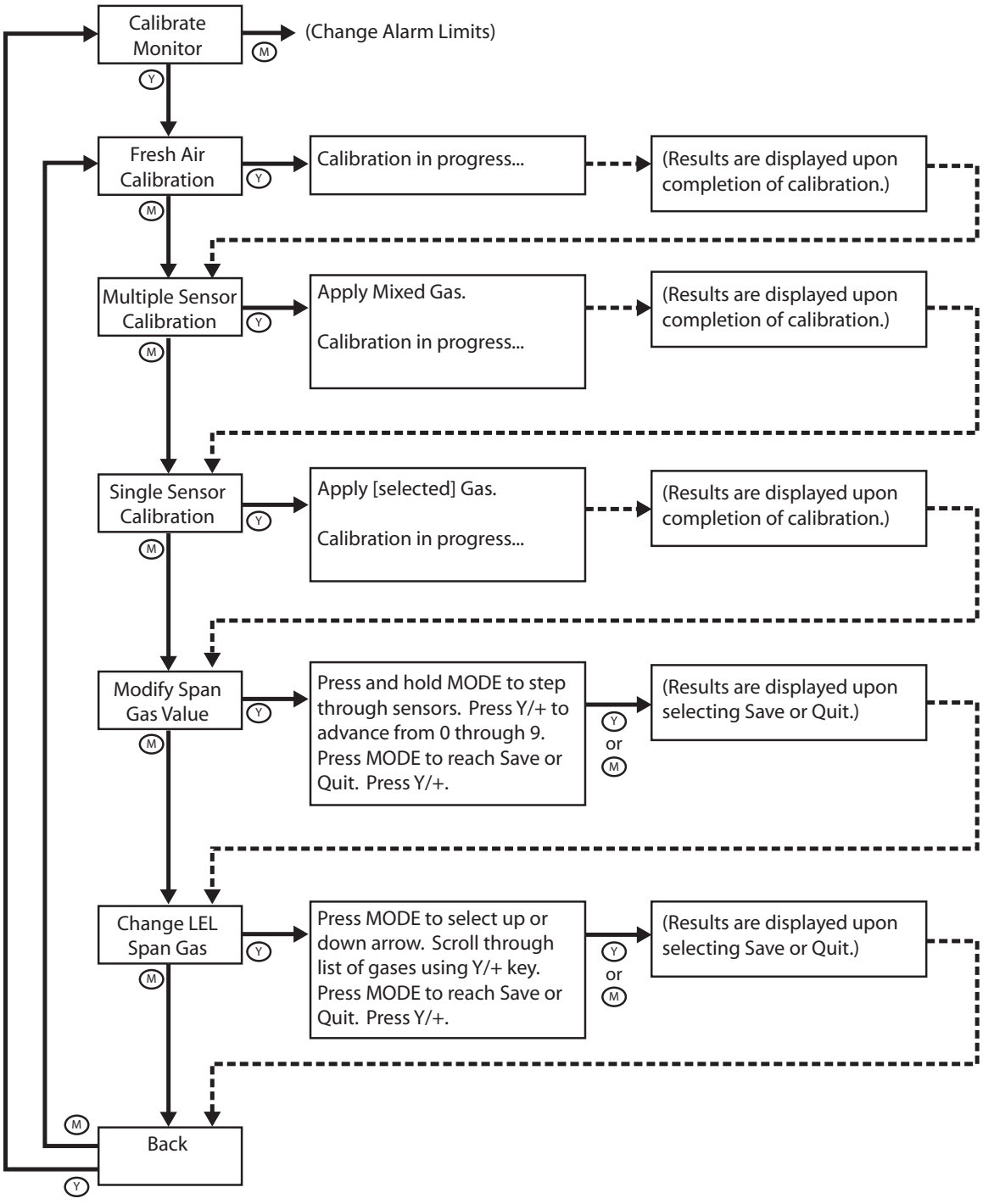
Note: Press [MODE] to navigate from one menu choice to the next and [Y/+] to make selections.



Calibrate Monitor

The QRAE II is designed to perform automated calibrations.

Note: The procedures for calibration are covered in a separate section, "Calibrating The QRAE II," on page 38.
The submenus and actions are shown in the following diagram.



Fresh Air Calibration. This sets the zero point of the sensor calibration curve for clean air. Expose the inlet to a clean air source with 20.9% oxygen and without any organic, toxic or combustible gas impurities. Follow the procedure outlined in "Zero (Fresh Air) Calibration" on page 39.

Multiple Sensor Calibration. This function simultaneously determines the second point of the calibration curve for multiple sensors in the monitor. To calibrate, follow the procedure outlined in "Calibrating The QRAE II," on page 38.

Single Sensor Calibration. This procedure determines the second point of the sensor calibration curve for a single sensor. To calibrate, follow the procedure outlined in "Calibrating The QRAE II," on page 38.

Modify Span Gas Value. This function allows selection of the gas concentration for each sensor.

Setting the span value separately for each sensor.

1. Select a sensor by pressing [MODE] until the sensor's name is highlighted.
2. Press [MODE] to advance through the digits on each sensor.
3. Press [Y/+] to increase the number (0 to 9).

   Note: Once the number reaches 9, pressing [Y/+] returns to 0 and starts counting up again each time [Y/+] is pressed.

4. Press and hold [MODE] for 3 seconds and release to advance to the next sensor.
5. After you have set all of the span values, hold [MODE] for 3 seconds and release. Save is highlighted.
6. Press [Y/+] to save your settings, or [MODE] to advance to Quit (without saving settings).

If you choose to quit without saving the changes, press [Y/+]. You will see this message:

Not Saved!

If you want to make further changes to the settings, press [MODE] to repeat stepping through the sensors.

Change LEL Span Gas. This function allows selection of the gas to be used for span calibration of the LEL sensor. The correction for the measurement gas is automatically divided by the correction factor the span gas, selected previously, to obtain a new factor for the combination of gases. The new factor is applied to the readings to obtain a true concentration.

1. Press [MODE] until the up or down arrow is highlighted.
2. Press [Y/+] to move through the list of LEL span gases.

3. Press [MODE] to select either the other arrow or to advance to Save or Quit.
4. With Save selected, press [Y/+] to save your settings, or [MODE] to advance to Quit (without saving settings).

If you choose to quit without saving the changes, press [Y/+]. You will see this message:

Not Saved!

If you want to make further changes to the settings, press [MODE] to repeat stepping through the choices.

Back. Press [MODE] to return to the top of the Calibrate Monitor menu, or press [Y/+] to return to the top of the Normal Mode menu.

Change Alarm Limits

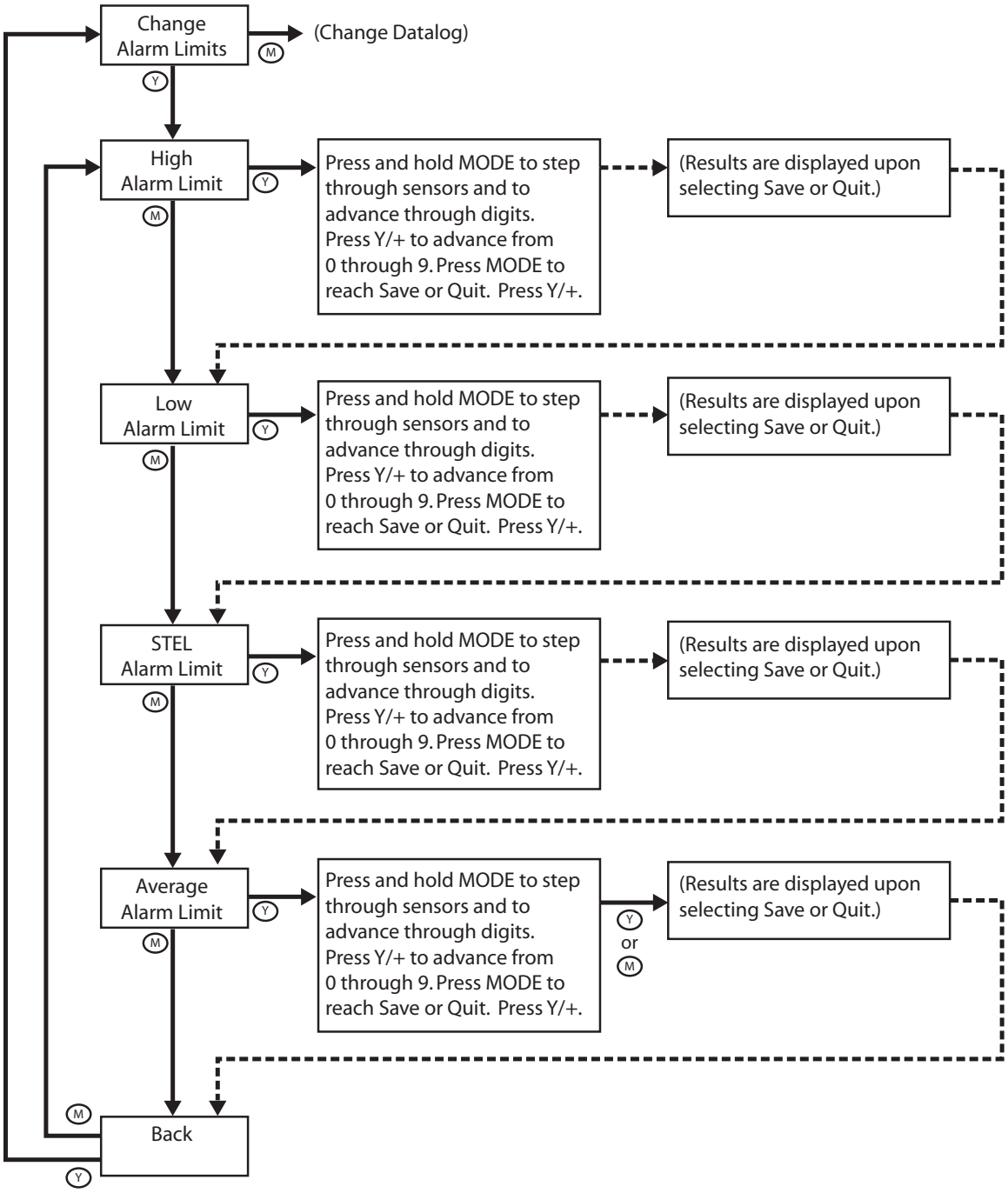
The high and low alarm limits, as well as the points at which the STEL and TWA alarms are triggered, can be modified in this set of menus. Each sensor's limits for each of these can be set separately, providing extremely precise alarm thresholds.

Alarm Signals. During each measurement period, the gas concentration is compared with the programmed alarm limits (gas concentration alarm limit settings: Low, High, TWA and STEL). If the concentration exceeds any of the preset limits, the loud buzzer, red flashing LED, and vibration alarm are activated immediately to warn of the alarm condition. In addition, the QRAE II alarms if one of the following conditions occurs: battery voltage falls below a preset voltage level (3.1 volts for Li-ion, 3.3 volts for alkaline batteries), or when the datalog memory is full. When the low battery alarm occurs, there will be approximately 20 to 30 minutes of operating time remaining. When the battery voltage falls below the low threshold, the QRAE II turns off automatically.

Submenus in this section are:

- High Alarm Limit
- Low Alarm Limit
- Stel Alarm Limit
- Average Alarm Limit

The submenus and actions are shown in the following diagram:


Change Alarm Limits
(Change Datalog)
M
Y
High Alarm Limit
Y
M
Press and hold MODE to step through sensors and to advance through digits. Press Y/+ to advance from 0 through 9. Press MODE to reach Save or Quit. Press Y/+.
(Results are displayed upon selecting Save or Quit.)
Low Alarm Limit
Y
M
Press and hold MODE to step through sensors and to advance through digits. Press Y/+ to advance from 0 through 9. Press MODE to reach Save or Quit. Press Y/+.
(Results are displayed upon selecting Save or Quit.)
STEL Alarm Limit
Y
M
Press and hold MODE to step through sensors and to advance through digits. Press Y/+ to advance from 0 through 9. Press MODE to reach Save or Quit. Press Y/+.
(Results are displayed upon selecting Save or Quit.)
Average Alarm Limit
Y
M
Press and hold MODE to step through sensors and to advance through digits. Press Y/+ to advance from 0 through 9. Press MODE to reach Save or Quit. Press Y/+.
Y
or
M
(Results are displayed upon selecting Save or Quit.)
M
Back
Y

Change High Alarm Limit. This function allows you to selectively set the high limit of individual sensors in the QRAE II.

1. Select a sensor by pressing [MODE] until the sensor's name is highlighted.
2. Press [MODE] to step through the sensor's digits.
3. Press [Y/+] to increase the number from 0 through 9. Once the number 9 is reached, pressing [Y/+] causes the numbers to "wrap around" to 0 and count up again.

4. Press and hold [MODE] for 3 seconds to advance to the next sensor.
5. Follow the same procedure as steps 2 and 3 for each sensor.

After you have modified all necessary sensor settings:

6. Press [MODE] to advance to Save or Quit.
7. With Save selected, press [Y/+] to save your settings, or [MODE] to advance to Quit (without saving settings).

Change Low Alarm Limit. This function allows you to selectively set the low limit of individual sensors in the QRAE II.

1. Select a sensor by pressing [MODE] until the sensor's name is highlighted.
2. Press [MODE] to step through the sensor's digits.
3. Press [Y/+] to increase the number from 0 through 9. Once the number 9 is reached, pressing [Y/+] causes the numbers to "wrap around" to 0 and count up again.
4. Press and hold [MODE] for 3 seconds to advance to the next sensor.
5. Follow the same procedure as steps 2 and 3 for each sensor.

After you have modified all necessary sensor settings:

6. Press [MODE] to advance to Save or Quit.
7. With Save selected, press [Y/+] to save your settings, or [MODE] to advance to Quit (without saving settings).

Change STEL Alarm Limit. This function allows you to selectively set the STEL (short term exposure limit) of individual sensors in the QRAE II. Note: This function does not include LEL or oxygen sensors.

1. Select a sensor by pressing [MODE] until the sensor's name is highlighted.
2. Press [MODE] to step through the sensor's digits.
3. Press [Y/+] to increase the number from 0 through 9. Once the number 9 is reached, pressing [Y/+] causes the numbers to "wrap around" to 0 and count up again.
4. Press and hold [MODE] for 3 seconds to advance to the next sensor.
5. Follow the same procedure as steps 2 and 3.

After you have performed all necessary modifications:

6. Press [MODE] to advance to Save or Quit.
7. With Save selected, press [Y/+] to save your settings, or [MODE] to advance to Quit (without saving settings).

Change Average Alarm Limit. This function allows you to selectively set the STEL (short term exposure limit) of individual sensors in the QRAE II. Note: This function does not include LEL or oxygen sensors.

1. Select a sensor by pressing [MODE] until the sensor's name is highlighted.
2. Press [MODE] to step through the sensor's digits.
3. Press [Y/+] to increase the number from 0 through 9. Once the number 9 is reached, pressing [Y/+] causes the numbers to "wrap around" to 0 and count up again.
4. Press and hold [MODE] for 3 seconds to advance to the next sensor.
5. Follow the same procedure as steps 2 and 3.

After you have performed all necessary modifications:

6. Press [MODE] to advance to Save or Quit.
7. With Save selected, press [Y/+] to save your settings, or [MODE] to advance to Quit (without saving settings).

Back. Press [MODE] to return to the top of the Change Alarm Limits menu, or press [Y/+] to return to the top of the Normal Mode menu.

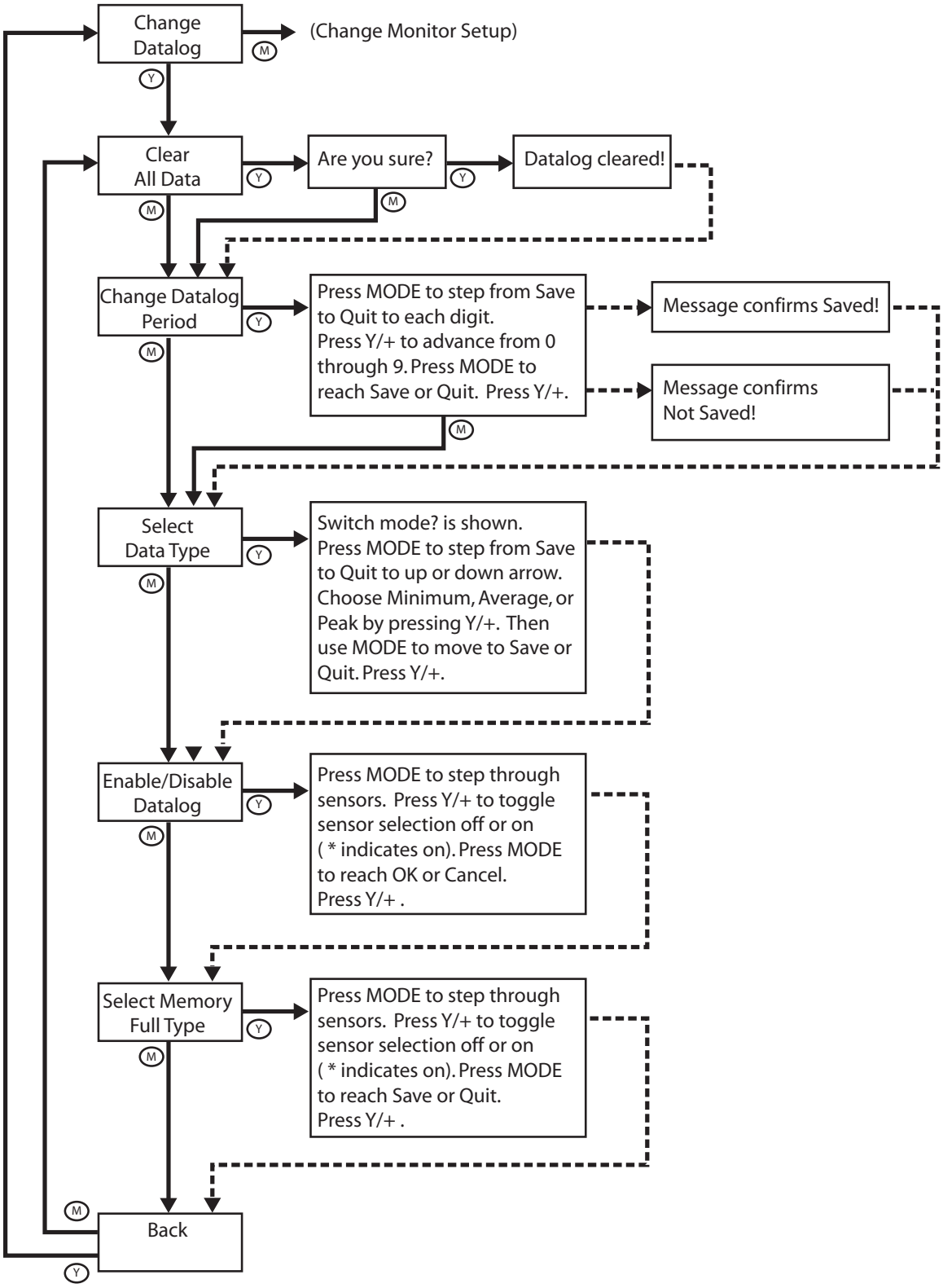
Change Datalog

The QRAE II calculates and stores the gas readings based on a user-specified datalogging period and the type of measurement. Average, peak and minimum values can be stored for each sensor during each datalogging interval. The datalogging interval can be programmed from one second to 3,600 seconds (60 minutes) in 1-second intervals. In addition, serial number, last calibration date, and alarm limits are stored. All data are retained in non-volatile memory for later download to a PC.

There are five submenus to Change Datalog:

- Clear All Data
- Change Datalog Period
- Select Data Type
- Enable/Disable Datalog
- Select Memory Full Type

The following diagram shows the navigation of this set of submenus:


Change Datalog
(Change Monitor Setup)
M
Y
Clear All Data
Y
Are you sure?
Y
Datalog cleared!
M
M
Change Datalog Period
Y
Press MODE to step from Save to Quit to each digit. Press Y/+ to advance from 0 through 9. Press MODE to reach Save or Quit. Press Y/+.
Message confirms Saved!
Message confirms Not Saved!
M
M
Select Data Type
Y
Switch mode? is shown. Press MODE to step from Save to Quit to up or down arrow. Choose Minimum, Average, or Peak by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
M
Enable/Disable Datalog
Y
Press MODE to step through sensors. Press Y/+ to toggle sensor selection off or on (* indicates on). Press MODE to reach OK or Cancel. Press Y/+ .
M
Select Memory Full Type
Y
Press MODE to step through sensors. Press Y/+ to toggle sensor selection off or on (* indicates on). Press MODE to reach Save or Quit. Press Y/+ .
M
M
Back
Y

Clear All Data. You can clear all data from the datalog. The QRAE II has a challenge that asks you to confirm that you want to clear the data.

1. Press [Y/+]. The display shows:

   Are you sure?

2. Press [Y/+] to clear the datalog or [MODE] if you do not want to clear the datalog. If you choose to clear it, the display shows:

   Datalog cleared!

   If you press [MODE], the display shows:

   Datalog not cleared.

Important! If you clear the datalog's data, it cannot be retrieved, or "unerased."

Change Datalog Period. The datalogging interval can be set from 1 second to 3,600 seconds (60 minutes). This is the time between data points. The QRAE II can store 64,000 datapoints.

1. Press [MODE] to step from Save and Quit and to advance through the digits.
2. Press [Y/+] to advance from 0 through 9. If you press [Y/+] when 9 is selected, it "wraps" around to 0 and begins counting up again each time you press [Y/+].
3. Press [MODE] to step to the next digit.
4. Press [Y/+] to advance from 0 through 9. Repeat steps 3 and 4 until you advance to Save or Quit.
5. Press [Y/+] to commit your change or to exit to the next menu item.

Select Data Type. You have three choices for the type of data collected in the QRAE II. You may select one. The screen shows:

Switch mode?

Your choices are:

- Average
- Peak
- Minimum

Press [MODE] to move from the up arrow to the down arrow to Save and to Quit. When the cursor is on the choice you want, press the [Y/+] key.

Enable/Disable Datalog? You can selectively enable or disable the data from each sensor to be stored in the datalog. This requires turning on or off each sensor in the menu.

1. Select a sensor to enable/disable by pressing [MODE] until the sensor's name is highlighted.
2. Press [Y/+] to toggle the selection on (indicated by an asterisk, *) or off (no asterisk).

   To select other sensors to datalog, press [MODE] until you reach the sensor you want to select. Then press [Y/+].

After you have selected all the sensors you want enabled or disabled:

3. Press [MODE] to advance to OK or Cancel.

With OK selected, press [Y/+] to save your settings, or press [MODE] to advance to Cancel (without saving settings).

Select Memory Full Type. You can set how the QRAE II deals with a full datalog memory. Once the datalog is full, it can either stop (retaining all data to that point) or wrap around, meaning that it begins overwriting the earliest data and proceeding to replace old data in an ongoing manner.

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose Stop or Wrap Around by pressing [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

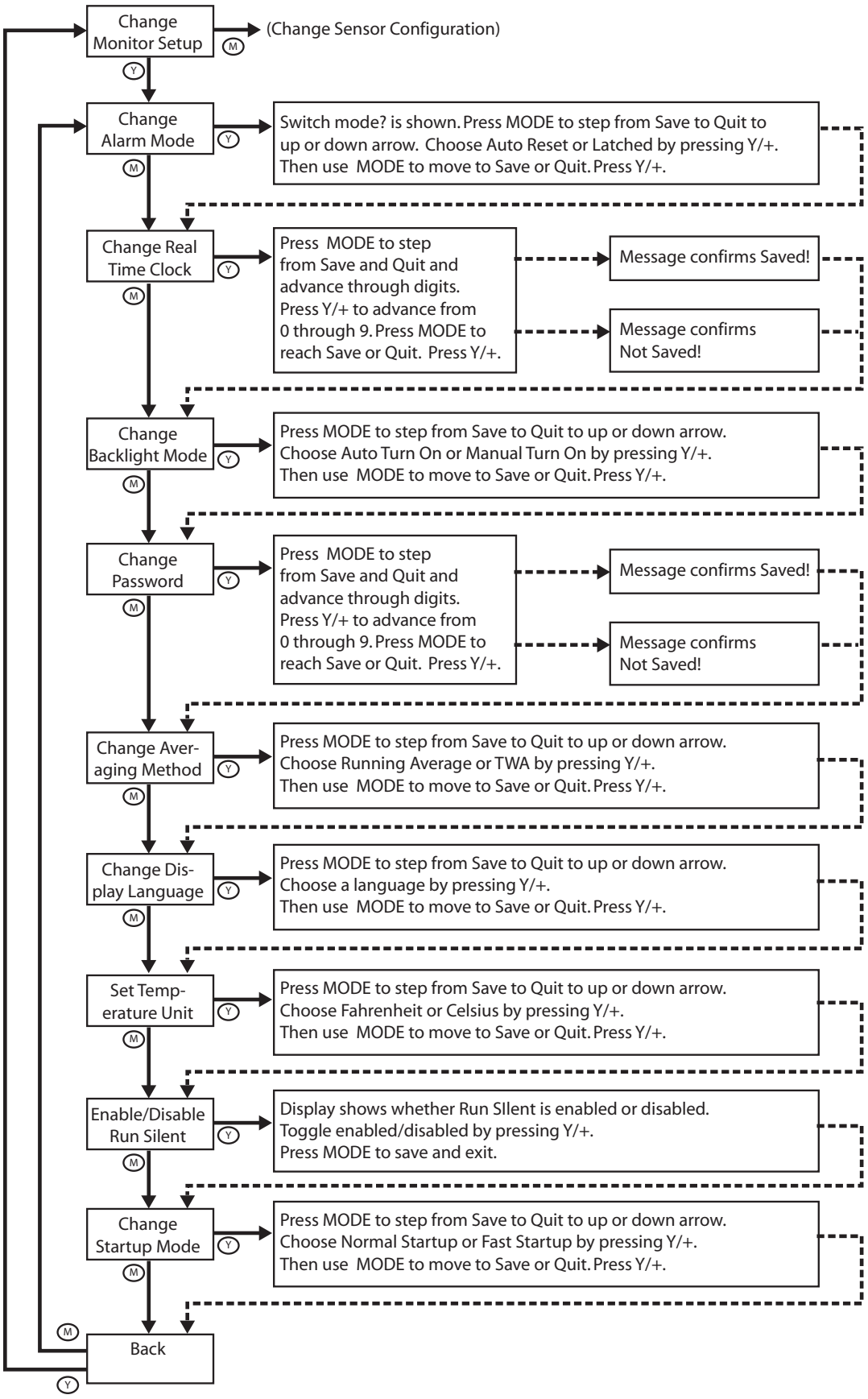
Back. Press [MODE] to return to the top of the Change Datalog menu, or press [Y/+] to return to the top of the Normal Mode menu.

Change Monitor Setup

This is the most extensive submenu set in the QRAE II. It includes:

- Change Alarm Mode
- Change Real Time Clock
- Change Backlight Mode
- Change Password
- Change Averaging Method
- Change Display Language
- Set Temperature Unit
- Enable/Disable Run Silent
- Change Startup Mode

The diagram on the next page shows how Change Monitor Setup is organized and how to navigate through it.


Change Monitor Setup
(Change Sensor Configuration)
Change Alarm Mode
Switch mode? is shown. Press MODE to step from Save to Quit to up or down arrow. Choose Auto Reset or Latched by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
Change Real Time Clock
Press MODE to step from Save and Quit and advance through digits. Press Y/+ to advance from 0 through 9. Press MODE to reach Save or Quit. Press Y/+.
Message confirms Saved!
Message confirms Not Saved!
Change Backlight Mode
Press MODE to step from Save to Quit to up or down arrow. Choose Auto Turn On or Manual Turn On by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
Change Password
Press MODE to step from Save and Quit and advance through digits. Press Y/+ to advance from 0 through 9. Press MODE to reach Save or Quit. Press Y/+.
Message confirms Saved!
Message confirms Not Saved!
Change Aver-aging Method
Press MODE to step from Save to Quit to up or down arrow. Choose Running Average or TWA by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
Change Dis-play Language
Press MODE to step from Save to Quit to up or down arrow. Choose a language by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
Set Temp-erature Unit
Press MODE to step from Save to Quit to up or down arrow. Choose Fahrenheit or Celsius by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
Enable/Disable Run Silent
Display shows whether Run SIlent is enabled or disabled. Toggle enabled/disabled by pressing Y/+. Press MODE to save and exit.
Change Startup Mode
Press MODE to step from Save to Quit to up or down arrow. Choose Normal Startup or Fast Startup by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
Back
M
Y

Change Alarm Mode. Your choices are Auto Reset and Latched. A latched alarm stays in alarm until you acknowledge the alarm by pressing a button. An auto-reset alarm turns off when the condition that set off the alarm is no longer present (for instance, a high H2S reading that exceeds the preset threshold and triggers an alarm, but then lowers below that threshold, turning the alarm off).

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose Auto Reset or Latched by pressing [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

Change Real Time Clock. Date (month, day, year) and time (hour, minute, second) are adjustable. Time is in 24-hour mode.

1. Press [MODE] to step from Save and Quit and to advance through the digits.
2. Press [Y/+] to advance from 0 through 9. If you press [Y/+] when 9 is selected, it "wraps" around to 0 and begins counting up again each time you press [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

Change Backlight Mode. In **Manual Turn On**, the backlight can be toggled on and off manually by pressing and holding **[Y/-]** for one second. In **Auto Turn On**, the backlight switches on automatically when the ambient light level exceeds a threshold. See Setting Backlight Mode on page 17 for details on setting the turn-on/turn-off threshold.

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose Manual Turn On or Auto Turn On by pressing [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

Change Password. You can change the 4-digit password from its default of 0000.

1. Press [MODE] to step from Save and Quit and to advance through the digits.
2. Press [Y/+] to advance from 0 through 9. If you press [Y/+] when 9 is selected, it "wraps" around to 0 and begins counting up again each time you press [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

Important! If you change the password, write down the new password and save it.

Change Averaging Method. Toggle between Running Average and TWA (time-weighted average).

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose Running Average or TWA by pressing [Y/+].

3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

Change Display Language. Scroll from English to other languages (language options depend on firmware version).

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose a language by pressing [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

Set Temperature Unit. Select Fahrenheit or Celsius.

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose Fahrenheit or Celsius by pressing [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

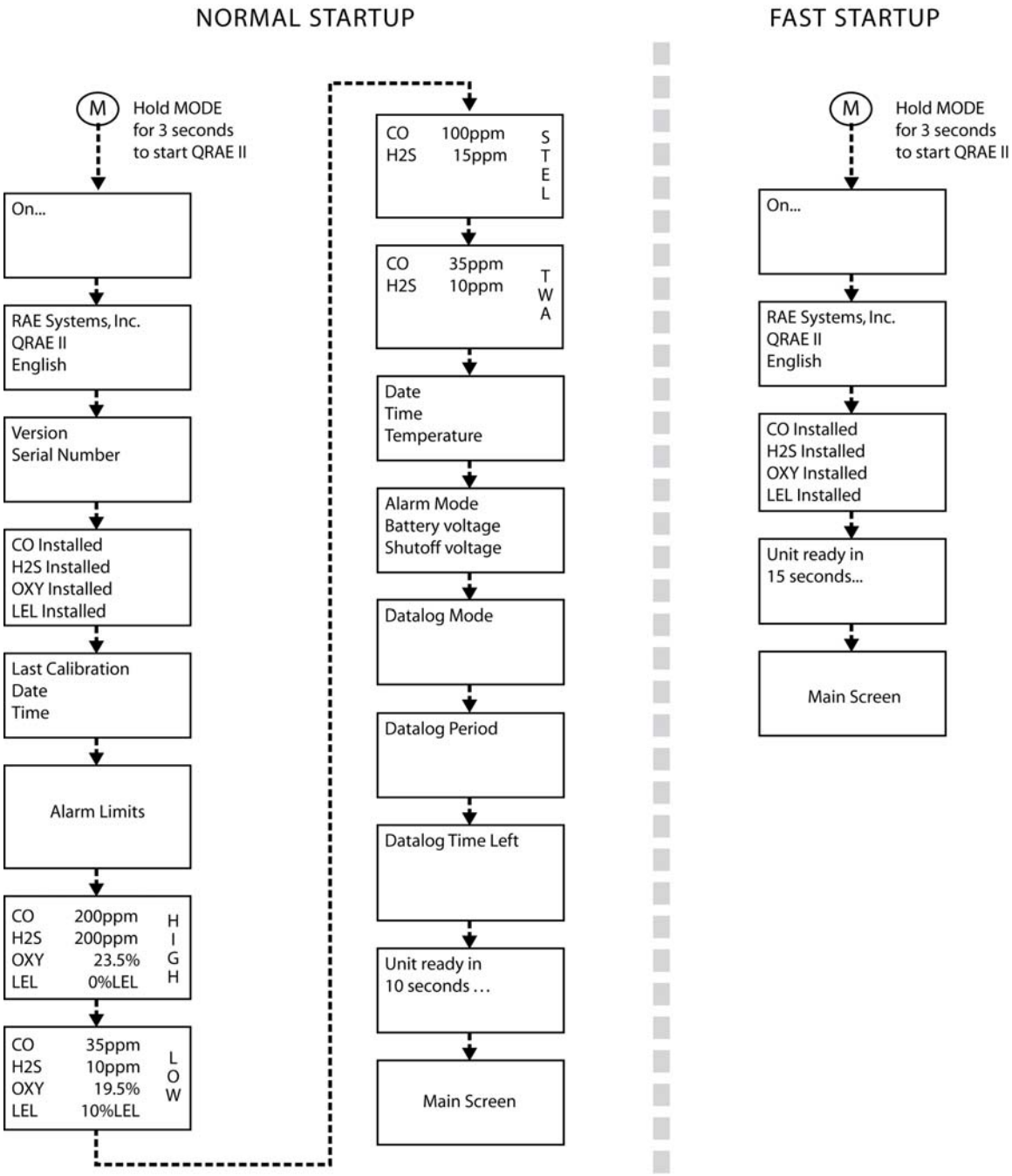
Enable/Disable Run Silent. You can select Run Silent Enabled or Run Silent Disabled modes.

1. Toggle enabled or disabled by pressing [Y/+].
2. Press [MODE] to save your choice and to exit to the next menu item.

Change Startup Mode. Options are Normal Startup and Fast Startup. Fast Startup skips showing you many settings and is best suited to environments where the QRAE II is turned on and off very often during a given day.

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose Normal Startup or Fast Startup by pressing [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

The diagram below shows the difference between the two startup modes:

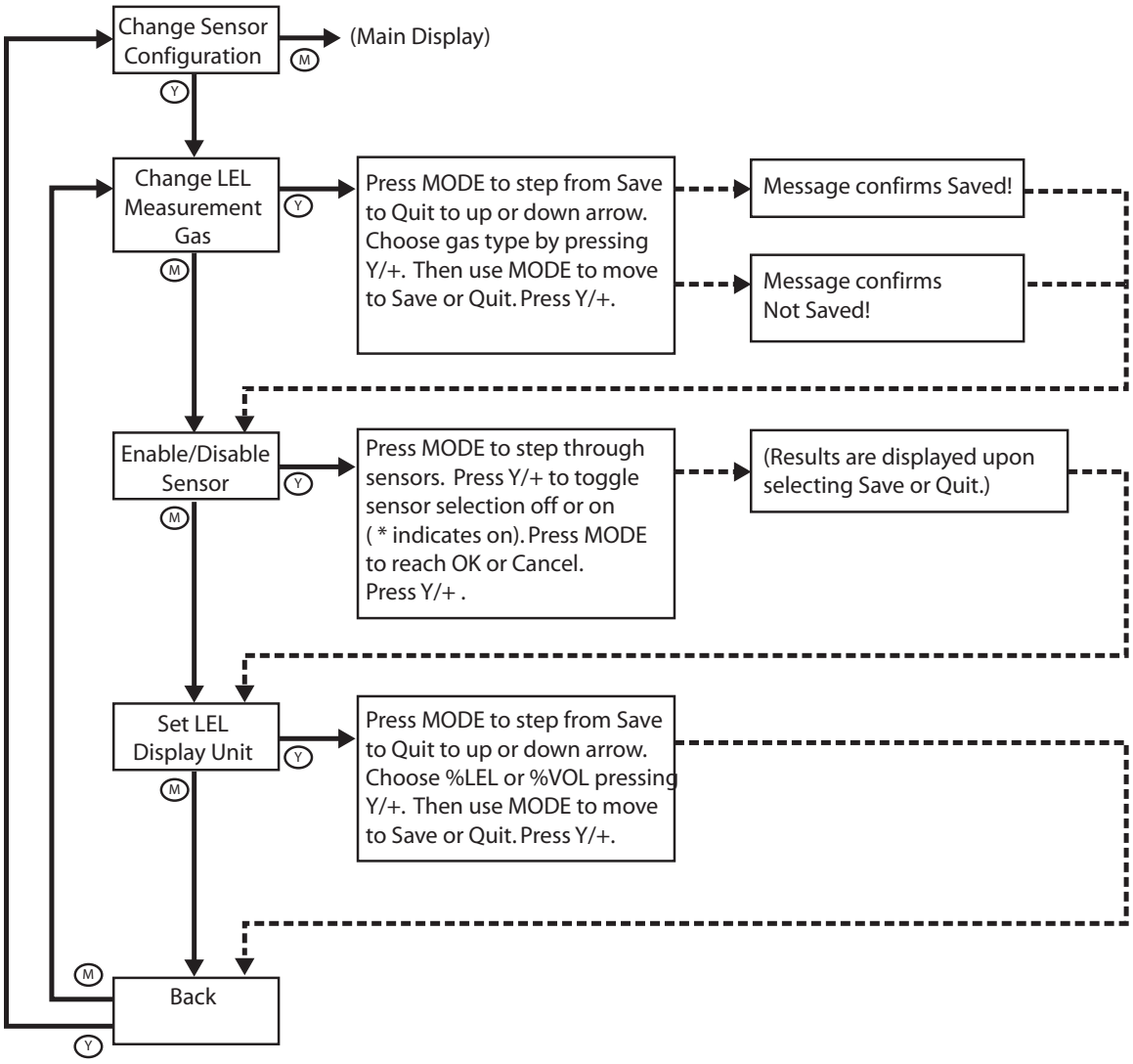


Back. Press [MODE] to return to the top of the Change Monitor Setup menu, or press [Y/+] to return to the top of the Normal Mode menu.

Change Sensor Configuration

You can select which sensors are enabled/disabled, and change the type of LEL measurement gas and unit of display for LEL in this set of submenus.

The following diagram shows how Change Sensor Configuration's menus are organized and how to navigate them:


Change Sensor Configuration
(Main Display)
M
Y
Change LEL Measurement Gas
Y
M
Press MODE to step from Save to Quit to up or down arrow. Choose gas type by pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
Message confirms Saved!
Message confirms Not Saved!
Enable/Disable Sensor
Y
M
Press MODE to step through sensors. Press Y/+ to toggle sensor selection off or on (* indicates on). Press MODE to reach OK or Cancel. Press Y/+ .
(Results are displayed upon selecting Save or Quit.)
Set LEL Display Unit
Y
M
Press MODE to step from Save to Quit to up or down arrow. Choose %LEL or %VOL pressing Y/+. Then use MODE to move to Save or Quit. Press Y/+.
M
Back
Y

Change LEL Measurement Gas. This function allows selection of the measurement gas for the LEL sensor. The correction for the measurement gas is automatically divided by the correction factor the span gas, selected previously, to obtain a new factor for the combination of gases. The new factor is applied to the readings to obtain a true concentration.

1. Press [MODE] until the up or down arrow is highlighted.
2. Press [Y+] to move through the list of LEL measurement gases.
3. Press [MODE] to select either the other arrow or to advance to Save or Quit.
4. With Save selected, press [Y/+] to save your settings, or [MODE] to advance to Quit (without saving settings).

If you choose to quit without saving the changes, press [Y/+]. You will see this message:

Not Saved!

If you want to make further changes to the settings, press [MODE] to repeat stepping through the choices.

Enable/Disable Sensor. This function allows you to selectively enable or disable individual sensors in the QRAE II. When a sensor is disabled, the unit does not datalog or display gas concentrations of that type.

8. Select a sensor to enable/disable by pressing [MODE] until the sensor's name is highlighted.
9. Press [Y/+] to toggle the selection on (indicated by an asterisk, *) or off (no asterisk).

   To select other sensors to calibrate, press [MODE] until you reach the sensor you want to select. Then press [Y/+].

After you have selected all the sensors you want enabled or disabled:

10. Press [MODE] to advance to Save or Cancel.
11. With Save selected, press [Y/+] to save your settings, or [MODE] to advance to Cancel (without saving settings).

Set LEL Display Unit. Choose from %LEL for percentage of lower explosive limit or %VOL for volume percent.

1. Press [MODE] to step from Save to Quit to the up or down arrow.
2. Choose %LEL or %VOL by pressing [Y/+].
3. Press [MODE] to step to Save or Quit.
4. Press [Y/+] to commit your change or to exit to the next menu item.

Back. Press [MODE] to return to the top of the Change Sensor Configuration menu, or [Y/+] to exit the Change Sensor Configuration menu and return to the Programming Mode menu.

Alarm Signal Summary

Note: Backlight automatically turns on when QRAE II alarms.

Over Range

Over Range:
Buzzer, LED: 3 times/second
Vibrator: 400ms/second

High Alarm

High Alarm:
Buzzer, LED: 3 times/second
Vibrator: 400ms/second

Low Alarm

Low Alarm:
Buzzer, LED: 2 times/second
Vibrator: 400ms/second

STEL Alarm

STEL Alarm:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

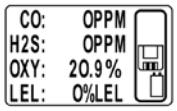
TWA Alarm

TWA Alarm:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

Negative Drift

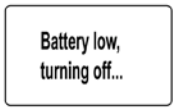
Negative Drift:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

Battery Low



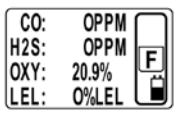
Battery Low:
Buzzer, LED: 1 time/minute
Vibrator: 400ms/minute

Battery Dead



Battery Dead:
LCD display "Battery low, turning off..."
Unit turns off after 15 seconds

Datalog Full



Datalog Full:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

Bump Testing & Calibrating The QRAE II

RAE Systems recommends that a bump test be performed on the QRAEII before the monitor is put into service, and later, prior to each use. A bump test is defined as a brief exposure of the monitor to the calibration gas and the sensors to show response and trigger the lowest alarm set point for each sensor.

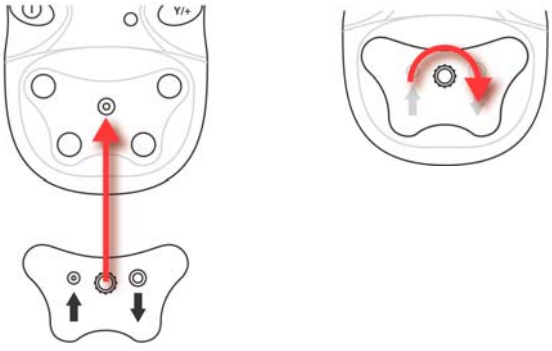
- The QRAEII Multi Gas detector must be calibrated if it does not pass a Bump Test, or at least once every 180 days, depending on use and sensor exposure to poisons and contaminants.
- Calibration intervals and bump test procedures may vary due to national legislation.
- RAE Systems recommends using RAE calibration gas cylinders with a 4 gas mix containing 10 ppm H2S, 50 ppm CO, 50% LEL Methane, and 18.5% Oxygen.

Note: Bump test and calibration can also be performed by using the RAE Systems AutoRAE™ docking station.

Connecting The Calibration Adapter

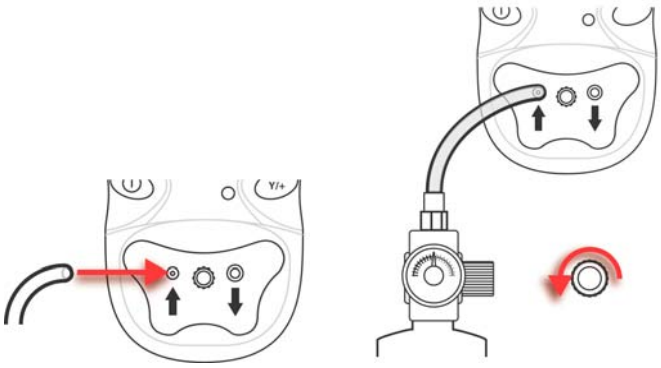
The QRAE II is a diffusion monitor and must be calibrated using a fixed-flow regulator with a flow rate between 0.5 and 1.0 liters per minute. The QRAE II is supplied with a special calibration adapter that covers the gas diffusion ports.

1. Place the Calibration Adapter over the filter area on the front of the QRAE II.
2. Finger-tighten the screw at the center, as shown:



Note: Finger-tighten this only. Do not use a pliers or other tools. The Calibration Adapter should be snug, but an air-tight seal is unnecessary.

3. Attach the hose from the regulator/calibration gas cylinder to the Calibration Adapter's inlet.



Caution! After calibration is complete, remove the Calibration Adapter. When monitoring, never operate the QRAE II with the Calibration Adapter attached. The QRAE II's sensors operate by diffusion. If the Calibration Adapter is attached during normal operation, inconsistent and lower-than-normal readings will occur because of decreased concentration of the gas being monitored.

Disconnecting The Calibration Adapter

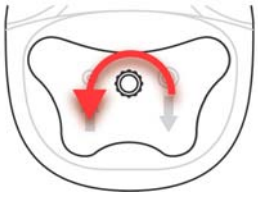
After calibrating the QRAE II, you must remove the Calibration Adapter.

Sensor Calibration Time

The QRAE II is designed to automatically use a predetermined calibration time. Never operate the QRAE II with the Calibration Adapter attached

To disconnect the Calibration Adapter:

1. Loosen the finger-screw at the center of the Calibration Adapter.



2. Lift the Calibration Adapter from the QRAE II and store it.

WARNING!

The calibration of any newly purchased RAE Systems instrument should be tested by exposing the sensor(s) to known concentration calibration gas(es) before the instrument is put into service the first time. For maximum safety, the accuracy of the QRAE II should be checked by exposing the sensor(s) to known concentration calibration gas(es) before each day's use.

Zero (Fresh Air) Calibration

This procedure determines the zero point of the sensor calibration curve. Expose the inlet to a clean air source with 20.9% oxygen and without any organic, toxic or combustible gas impurities. This "Zero Air" can be from a cylinder, clean ambient air, or ambient air purified through a charcoal filter.

Using Fresh Air

Caution! Do not use the Calibration Adapter while performing zero calibration in fresh air.

Turn on the QRAE II and follow this procedure:

1. Enter Program Mode.
2. At Calibrate Monitor, press [Y/+].

You should see:

Fresh Air Calibration?

3. Press Y+ to start calibration. Calibration is performed automatically.

Using Zero Gas

1. Attach the Calibration Adapter to the QRAE II.
2. Attach the regulator to the Zero Gas cylinder.
3. Attach a hose to the Calibration Adapter and to the regulator.
4. Enter Password.
5. At Calibrate Monitor, press [Y/+].
6. When you see Fresh Air Calibration? turn on the regulator to start the Zero Gas flow.
7. Press [Y/+].

You should see a countdown from 30 seconds:

Calibration
in progress ... 30

When calibration is complete, you will see the screen change between these two:

CO:	**Zeroed**		**CO:**	**0ppm**
H2S:	**Zeroed**	**and**	**H2S:**	**0ppm**
OXY:	**Zeroed**		**OXY:**	**20.9%**
LEL:	**Zeroed**		**LEL:**	**0%LEL**

When the zero calibration is successful, the display should show a reading of "20.9" for the oxygen sensor and "0" for all other sensors.

Multiple Sensor Calibration

This function simultaneously determines the second point of the calibration curve for multiple sensors in the monitor. The display counts down from 60 to 0 seconds, and then shows the name of each sensor, whether it passed or failed calibration, and the calibrated value for each sensor.

Select a sensor to calibrate by pressing [MODE] until the sensor's name is highlighted. Then press [Y/+] to toggle the selection on (indicated by an asterisk, *) or off (no asterisk). To select other sensors to calibrate, press [MODE] until you reach the sensor you want to select. Then press [Y/+].

After you have selected all the sensors you want calibrated, it is time to perform the calibration.

1. Attach the Calibration Adapter to the QRAE II.
2. Attach the regulator to the Calibration Gas cylinder.
3. Attach a hose to the Calibration Adapter and to the regulator.
4. Turn on the regulator to start the Calibration Gas flow.
5. Press [MODE] until OK is highlighted.
6. Press [Y/+] to start calibration.

You should see a countdown from 60 seconds:

Calibration
in progress ... 60

Note: If you see the following message, check that the gas is flowing and the hose is attached:

No Gas Flow... Apply gas or hit any key to start.

When calibration is complete, you will see the screen change between these two:

Multiple Sensor Calibrated!

and

CO = Pass
H2S = Pass
O2 = Pass
LEL = Pass

A sensor calibration failure is indicated like this:

CO = Fail
H2S = Pass
O2 = Pass
LEL = Pass

If a sensor fails, try calibrating again. If calibration fails again, replace the sensor.

Single Sensor Calibration

This procedure determines the second point of the sensor calibration curve for a single sensor. The display counts down from 60 to 0 seconds, and then shows the name of each sensor, whether it passed or failed calibration, and the calibrated value for each sensor.

Select the sensor to calibrate by pressing [MODE] until the sensor's name is highlighted. Then press [Y/+] to toggle the selection on (indicated by an asterisk, *) or off (no asterisk).

After you have selected the sensor you want calibrated, it is time to perform the calibration.

1. Attach the Calibration Adapter to the QRAE II.
2. Attach the regulator to the Calibration Gas cylinder.

   Important! Make sure you have the correct calibration gas in the correct concentration. Also make sure that the calibration gas is not beyond its "Best when used by" date, which is stamped on the cylinder's label.

3. Attach a hose to the Calibration Adapter and to the regulator.
4. Turn on the regulator to start the Calibration Gas flow.
5. Press [MODE] until OK is highlighted.
6. Press [Y/+] to start calibration.

You should see a countdown from 60 seconds:

Calibration
in progress ... 60

Note: If you see the following message, check that the gas is flowing and the hose is attached:

No Gas Flow... Apply gas or hit any key to start.

When calibration is complete, you will see the screen change between these two:

Multiple Sensor Calibrated!

and

CO = Pass
H2S = Pass
O2 = Pass
LEL = Pass

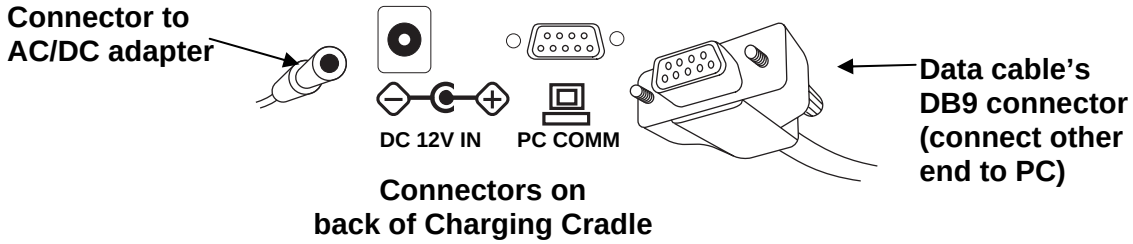
If the sensor calibration passes, then you should see this message (shown here for carbon monoxide, CO):

CO calibration pass!

If the sensor calibration fails, try calibrating again. If calibration fails again, replace the sensor.

Connecting To A Computer

Downloading datalog data to computer requires placing the QRAE II in its cradle and connecting the cradle to a computer.


Connector to AC/DC adapter
DC 12V IN
PC COMM
Data cable's DB9 connector (connect other end to PC)
Connectors on back of Charging Cradle

The QRAE II's cradle connects via a DB9 (9-pin) connector to a computer running ProRAE Remote software.

Press the DB9 connector into the DB9 serial port on the cradle, and then finger-tighten the two screws on the connector. These keep the connector from coming loose and ensure the best electrical connection. Make sure the AC/DC adapter is connected to the cradle, as well, to power the QRAE II and keep its battery from draining.

Note: If your computer has a USB port instead of a DB9 connector, use a USB to 9-pin serial adapter (part number 410-0210-000).

Transferring Data To & From A Computer

Once you have connected your QRAE II cradle to the PC, you can can transfer data, including a download of the datalog to the computer and updates of firmware to the QRAE II (should this ever be necessary).

Downloading The Datalog To A PC

1. Connect the data cable to the PC and the cradle.
2. Place the QRAE II into its cradle. The charging LED should be illuminated.
3. Start ProRAE Studio on your PC.
4. From ProRAE Studio, select "Operation" and select Setup Connection.
5. Select the COM port to establish a communication link between the PC and the QRAE II.
6. To receive the datalog in the PC, select "Downlog Datalog."
7. When you see "Unit Information," click OK.

The download process typically takes less than 10 seconds. During the data transfer, the display shows a progress bar.

When the transfer is done, you will see a screen with the datalog information. You can now export this datalog for other use or printing.

Uploading Firmware To The QRAE II From A PC

Uploading new firmware to your QRAE II requires connecting the QRAE II and PC. Follow these steps to make the connection:

1. Connect the data cable to the PC and the cradle.
2. Place the QRAE II into its cradle. The charging LED should be illuminated.
3. Start ProRAE Studio on your PC.
4. From ProRAE Studio, select "Operation" and select Setup Connection.
5. Select the COM port to establish a communication link between the PC and the QRAE II.

Once communication is established, follow the instructions that accompany ProRAE Studio and the firmware to upload the new firmware to your QRAE II.

Maintenance

⚠ WARNING! ⚠

Maintenance should be performed only by a qualified person who has proper training and fully understands the contents of this manual.

The following guidelines should be followed when changing components:

1. Turn off the unit and unplug the charger before changing a battery.
2. When changing a sensor, detach the battery first. Identify the location of a specific sensor and pay attention to the sensor pin orientation when removing and plugging in sensors.

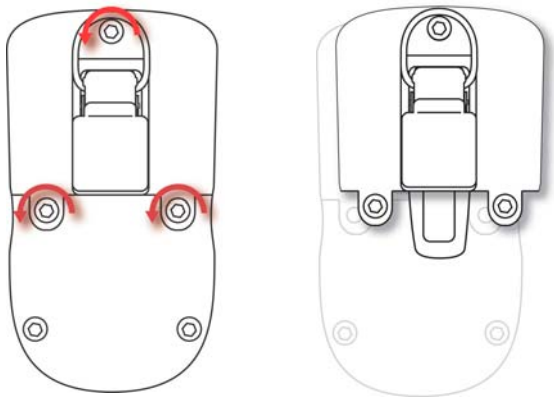
WARNING

To reduce the risk of ignition of hazardous atmospheres, recharge battery only in area known to be non-hazardous. Remove and replace battery only in an area known to be non-hazardous.

Replacing the QRAE II Li-Ion Battery

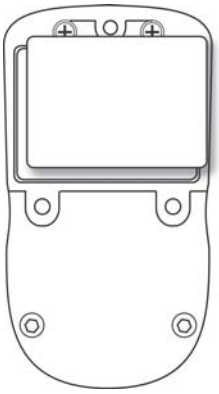
Caution: Turn off the QRAE II before removing or replacing the battery.

1. Place the QRAE II face-down on a soft surface.
2. Use the hex wrench to loosen each of the three screws by turning them counterclockwise.

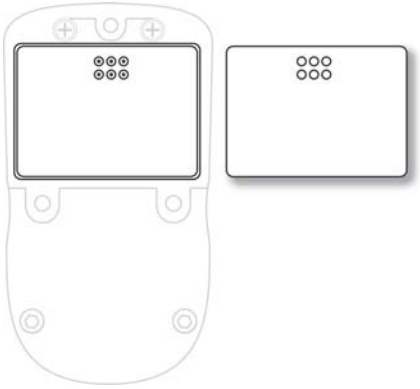


3. Hold the QRAE II down and lift the compartment cover by pulling on the belt clip.

4. Turn the QRAE over and slide the battery out of its compartment.



5. Place the new battery into the compartment with its six gold-plated contacts aligned over the six pins.



Note: Before installing the new battery, visually inspect the contacts to make sure they are clean. If they are not, wipe them with a soft cloth. Do not use solvents or cleaners.

6. Place the cover over the compartment.
7. Tighten all three screws by turning them clockwise with the hex wrench.

Installing The Alkaline Battery Adapter

The Alkaline Battery Adapter substitutes for the Li-Ion battery. The adapter (part number 020-3403-000) accepts three AA alkaline batteries (use only Duracell MN1500 or Energizer E91) to provide approximately 12 hours of operation.

2. Place the QRAE II face-down on a soft surface.
3. Use the hex wrench to loosen each of the three screws by turning them counterclockwise.
4. Hold the QRAE II down and lift the compartment cover by pulling on the belt clip.
5. Turn the QRAE over and slide the Li-ion battery out of its compartment.

6. Install three AA alkaline batteries into the Alkaline Battery Adapter, making sure the battery polarity is correct.
7. Place the Alkaline Battery Adapter into the compartment with its six gold-plated contacts aligned over the six pins.
8. Place the cover over the compartment.
9. Tighten all three screws by turning them clockwise with the hex wrench.
10. The monitor automatically detects the alkaline batteries.

IMPORTANT!

Alkaline batteries cannot be recharged. The QRAE II's internal circuit detects alkaline batteries and will not allow recharging. If you place the QRAE II in its cradle, the alkaline battery will not be recharged, and you will see this icon:

Note: When replacing alkaline batteries, dispose of old ones properly.

WARNING!

To reduce the risk of ignition of hazardous atmospheres, recharge the battery only in areas known to be non-hazardous. Remove and replace the battery only in areas known to be non-hazardous.

Charging A Spare QRAE II Li-Ion Battery

A QRAE II Li-ion battery can be charged when it is not inside the QRAE II. The charging cradle is designed to accommodate both types of charging. Contacts on the bottom of the QRAE II battery meet the contacts on the cradle, transferring power without other connections, and two clips hold the battery in place during charging.

1. Plug the AC/DC adapter into the QRAE II's cradle.
2. Place the battery into the cradle, with the six gold-plated contacts on top of the six matching charging pins.
3. Plug the AC/DC adapter into the wall outlet.

The QRAE II battery begins charging automatically. During charging, the LED in the cradle glows red. When charging is complete, it glows green.

Release the battery from the cradle by pressing the keys on both sides of the cradle and lifting the battery out of its slot.

Note: If you need to replace the 3.7V Li-ion battery pack, replacements are available from RAE Systems. The part number is 020-3402-000.

Replacing Sensors

Under normal operating conditions, sensors lose their original sensitivity after the expected operating life and need to be replaced.

Warranties: The oxygen (O_2), combustible gas (LEL), hydrogen sulfide (H_2S) and carbon monoxide (CO) sensors all have a 2-year warranty.

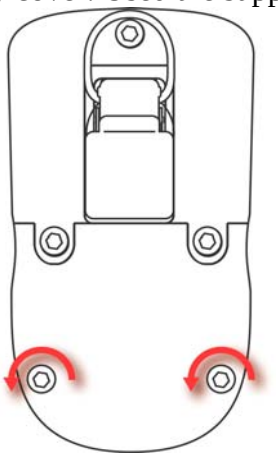
Replace a sensor when it fails to calibrate. If it fails to calibrate, retry calibrating it. Check the QRAE II's parameter settings, and check that the calibration gas is not beyond its "Use by" date. For further details, refer to RAE Systems Technical Note TN-123, "Special Diagnostic Modes For RAE Systems Instruments," available at www.raesystems.com.

The sensors are located inside the front of the monitor.

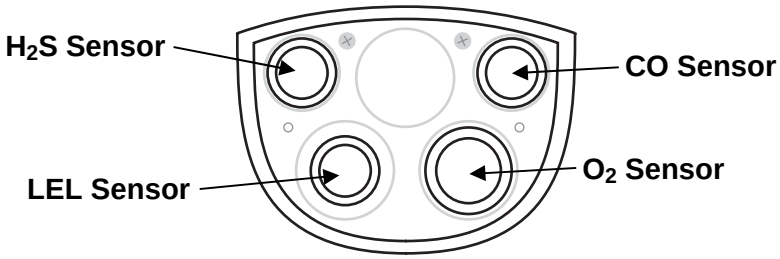
See RAE Systems Technical Note TN-114, Sensor Specifications And Cross-Sensitivities, for additional information, available at www.raesystems.com.

To replace a sensor:

1. Turn off the QRAE II.
2. Place the QRAE II face-down on a soft surface.
3. Remove the front sensor cover by loosening the two screws on the back of the monitor below the battery cover. Used the supplied hex wrench.



4. Push the screws from the back of the monitor to pop the cover off the front.
5. Locate the sensor you need to replace.



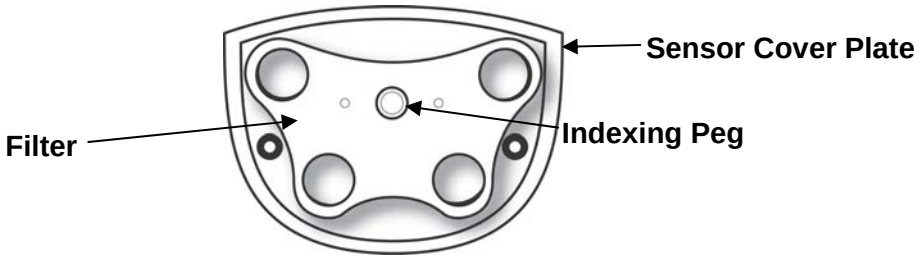
6. Using the sensor puller, carefully remove the sensor by pulling it straight out.
7. Replace the sensor with a new one. Make sure the pins are not bent or corroded. Align the pins to the corresponding holes and push straight in. Do not push on the middle of the sensor with your finger, as this may damage it. The sensor should fit flush against the printed circuit board.

   Note: Each sensor socket is labeled to guide you in placing the correct sensor into it. If a sensor does not seem to fit, examine it to ensure that it is the correct sensor, the pins are not bent, and that the pins are aligned to the holes.

8. Press the sensors all the way into the socket.

   Important! Sensors are not interchangeable. Use only RAE Systems sensors, and use only the sensor type specified for your QRAE II monitor. Use of non-RAE Systems components will void the warranty and can compromise the safe performance of this product.

9. Inspect the filter. If it is dirty, discolored, or wet, replace it. See Replacing The Filter, below.



10. Place the filter onto the inside of the sensor cover. Make sure it is aligned properly by matching its center hole with the indexing peg at the middle of the cover.
11. Replace the sensor cover. Hold the cover against the QRAE II and place the QRAE II on a soft surface. Use the hex wrench to tighten the two screws. Do not overtighten them.
12. Turn the monitor on and the newly installed sensors should be properly identified by the EntryRAE in the start-up screen. Let the monitor run for 15 minutes before calibration.
13. Calibrate all sensors prior to using the QRAE II.

Replacing The Filter

The filter is made of PTFE (Teflon®) membrane designed to prevent water and dust from entering the sensors. The filter should be replaced if it changes color, traps dust or other particulates, or if it has been saturated with water or other liquids. Use only the filter with part number 020-2419-000.

Cleaning

Occasional cleaning with a soft cloth is recommended. Do not use detergents or chemicals. Do not submerge the QRAE II or place it under running water. If necessary, you can use a damp cloth (water only). It is a good idea to install the Calibration Adapter before cleaning the QRAE II's housing, to keep dirt, dust, or moisture away from the sensor openings and to keep the filter clean.

Visually inspect the contacts at the base of the QRAE II, on the battery, and on the Charging cradle to make sure they are clean. If they are not, wipe them with a soft, dry cloth. Never use solvents or cleaners.

Troubleshooting

Problem	Possible Reasons & Solutions	
Cannot turn on power after charging the battery	**Reasons:**	Discharged battery. Defective battery.
	Solutions:	Charge or replace battery.
No LCD back light	**Reasons:**	Trigger level too low, the current mode is not user mode, and the mode does not support automatic turn on back light.
	Solutions:	Adjust trigger level. Verify the back light can be turned on. Verify that the backlight is not in manual mode. Call authorized service center.
Lost password	**Solutions:**	Call Technical Support at +1 408-752-0723 or toll-free at +1 888-723-4800
Reading abnormally Low	**Reasons:**	Dirty filter. Calibration Adapter is attached. Incorrect calibration.
	Solutions:	Replace filter. Remove Calibration Adapter. Calibrate the QRAE II.
Buzzer Inoperative	**Reasons:**	Bad buzzer.
	Solutions:	Check that buzzer is not turned off. Call authorized service center.

Appendix A: Regulatory Information

Intrinsic Safety:	CSA Class 1, Division I, Group A, B, C, D, T4 (US & Canada), KEMA ATEX II 2G EEx d ia II C T4 (Europe)
EM Immunity:	No effect when exposed to 0.43mW/cm^2 RF interference (5-watt transmitter at 12"/10cm).
Temperature:	-20° C to 50° C (-4° F to 122° F)
Humidity:	0% to 95% relative humidity (non-condensing)

Caution:

Refer to RAE Systems Technical Note TN-114 for sensor cross-sensitivities.
Refer to RAE Systems Technical Note TN-144 for LEL sensor poisoning.

Basic Operation

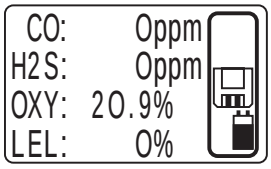
Turning The QRAE II On

To turn the QRAE II on, hold down [MODE] for 2 seconds.

The QRAE performs self-testing and the screen shows a countdown to full operational functionality. If Datalog is on, this message is displayed after the countdown:

Datalog Started

When the QRAE II is ready for use, it shows this screen:



Note: If datalogging is off, you will not see the datalogging icon (see icons, page 10).

Turning The QRAE II Off

Press and hold [MODE]. In 2 seconds, a 5-second countdown to shutoff begins. You must hold your finger on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the QRAE II continues normal operation.

The countdown proceeds as follows, accompanied at each step with an alarm beep and light flash.

When you see "Unit off..." release your finger from the [MODE] key. The QRAE II is now off.

Inverting The Display

To flip the screen, press the [Y/+] key and hold it down for 3 seconds. When the image inverts, release the key.

Testing The Alarms (Anytime)

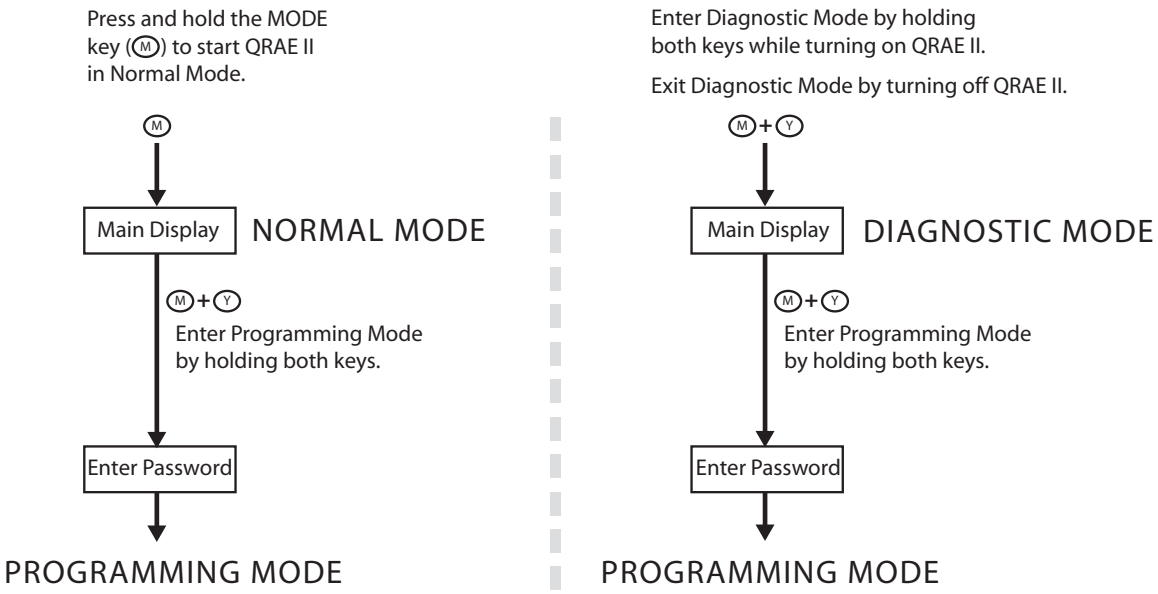
Under normal non-alarm conditions, the buzzer, vibration alarm, LED, and backlight can be tested at any time by pressing [Y/+] once.

Programming Mode

Enter Programming Mode from Normal Mode or Diagnostic Mode. This mode contains most adjustable settings for the QRAE II. It is organized into five submenus:

- Calibrate Monitor
- Change Alarm Limits
- Change Datalog
- Change Monitor Setup
- Change Sensor Configuration

The following diagram shows how to enter Programming Mode from Normal Mode and from Diagnostic Mode:


Press and hold the MODE key (M) to start QRAE II in Normal Mode.
M
Main Display
NORMAL MODE
M+Y
Enter Programming Mode by holding both keys.
Enter Password
PROGRAMMING MODE
Enter Diagnostic Mode by holding both keys while turning on QRAE II.
Exit Diagnostic Mode by turning off QRAE II.
M+Y
Main Display
DIAGNOSTIC MODE
M+Y
Enter Programming Mode by holding both keys.
Enter Password
PROGRAMMING MODE

Change Alarm Mode. Your choices are Auto Reset and Latched. A latched alarm stays in alarm until you acknowledge the alarm by pressing a button. An auto-reset alarm turns off when the condition that set off the alarm is no longer present (for instance, a high H2S reading that exceeds the preset threshold and triggers an alarm, but then lowers below that threshold, turning the alarm off).

5. Press [MODE] to step from Save to Quit to the up or down arrow.
6. Choose Auto Reset or Latched by pressing [Y/+].
7. Press [MODE] to step to Save or Quit.
8. Press [Y/+] to commit your change or to exit to the next menu item.

Alarm Signal Summary

Note: Backlight automatically turns on when QRAE II alarms.

Over Range

Over Range:
Buzzer, LED: 3 times/second
Vibrator: 400ms/second

High Alarm

High Alarm:
Buzzer, LED: 3 times/second
Vibrator: 400ms/second

Low Alarm

Low Alarm:
Buzzer, LED: 2 times/second
Vibrator: 400ms/second

STEL Alarm

STEL Alarm:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

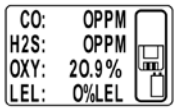
TWA Alarm

TWA Alarm:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

Negative Drift

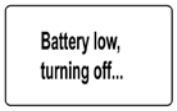
Negative Drift:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

Battery Low



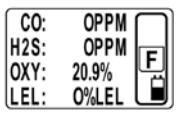
Battery Low:
Buzzer, LED: 1 time/minute
Vibrator: 400ms/minute

Battery Dead



Battery Dead:
LCD display "Battery low, turning off..."
Unit turns off after 15 seconds

Datalog Full



Datalog Full:
Buzzer, LED: 1 time/second
Vibrator: 400ms/second

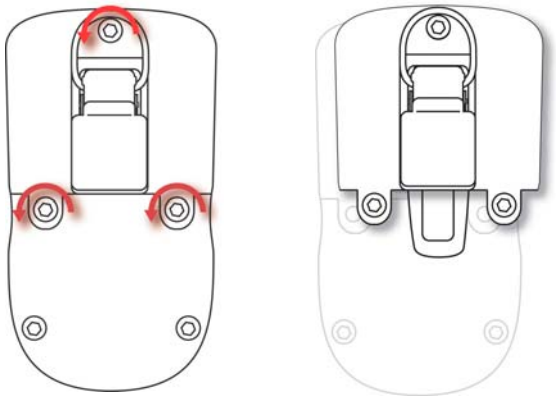
WARNING

To reduce the risk of ignition of hazardous atmospheres, recharge battery only in area known to be non-hazardous. Remove and replace battery only in an area known to be non-hazardous.

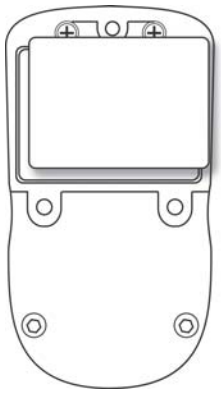
Replacing the QRAE II Li-Ion Battery

Caution: Turn off the QRAE II before removing or replacing the battery.

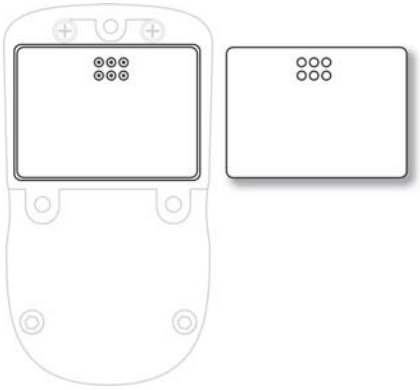
1. Place the QRAE II face-down on a soft surface.
2. Use the hex wrench to loosen each of the three screws by turning them counterclockwise.



3. Hold the QRAE II down and lift the compartment cover by pulling on the belt clip.
4. Turn the QRAE over and slide the battery out of its compartment.



5. Place the new battery into the compartment with its six gold-plated contacts aligned over the six pins.



Note: Before installing the new battery, visually inspect the contacts to make sure they are clean. If they are not, wipe them with a soft cloth. Do not use solvents or cleaners.

6. Place the cover over the compartment.
7. Tighten all three screws by turning them clockwise with the hex wrench.

Installing The Alkaline Battery Adapter

The Alkaline Battery Adapter substitutes for the Li-Ion battery. The adapter (part number 020-3403-000) accepts three AA alkaline batteries (use only Duracell MN1500 or Energizer E91) to provide approximately 12 hours of operation.

Place the QRAE II face-down on a soft surface.

1. Use the hex wrench to loosen each of the three screws by turning them counterclockwise.
2. Hold the QRAE II down and lift the compartment cover by pulling on the belt clip.
3. Turn the QRAE over and slide the Li-ion battery out of its compartment.
4. Install three AA alkaline batteries into the Alkaline Battery Adapter, making sure the battery polarity is correct.
5. Place the Alkaline Battery Adapter into the compartment with its six gold-plated contacts aligned over the six pins.
6. Place the cover over the compartment.
7. Tighten all three screws by turning them clockwise with the hex wrench.
8. The monitor automatically detects the alkaline batteries.

Replacing The Filter

The filter is made of PTFE (Teflon®) membrane designed to prevent water and dust from entering the sensors. The filter should be replaced if it changes color, traps dust or other particulates, or if it has been saturated with water or other liquids. Use only the filter with part number 020-2419-000.

Troubleshooting

Problem	Possible Reasons & Solutions
Cannot turn on power after charging the battery	**Reasons:** Discharged battery. Defective battery. **Solutions:** Charge or replace battery.
No LCD back light	**Reasons:** Trigger level too low, the current mode is not user mode, and the mode does not support automatic turn on back light. **Solutions:** Adjust trigger level. Verify the back light can be turned on. Verify that the backlight is not in manual mode. Call authorized service center.
Lost password	**Solutions:** Call Technical Support at +1 408-752-0723 or toll-free at +1 888-723-4800
Reading abnormally Low	**Reasons:** Dirty filter. Calibration Adapter is attached. Incorrect calibration. **Solutions:** Replace filter. Remove Calibration Adapter. Calibrate the QRAE II.
Buzzer Inoperative	**Reasons:** Bad buzzer. **Solutions:** Check that buzzer is not turned off. Call authorized service center.

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

UK Office
Keison Products,
P.O. Box 2124, Chelmsford, Essex, CM1 3UP, England.
Tel: +44 (0)1245 600560
Fax: +44 (0)1245 808399
Email: sales@keison.co.uk

Please note - Product designs and specifications are subject to change without notice. The user is responsible for determining the suitability of this product.